The UNESCO Courier

A window open on the world

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SCIENCE AND MYTH

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TREASURES
OF
WORLD ART

74 *SPAIN*

Lady of Baza

Dating back some 2,400 years, this statue (detail of a figure seated on a winged throne) was unearthed from an ancient burial ground at Baza (hence its name " Lady of Baza ") in Granada (Spain), and may have served as a funerary urn. Spanish archaeologists have uncovered striking pieces of Iberian monumental carving with a distinctive " oriental " style, including statues of priestesses, the famous " Lady of Elche ", found on a site 120 miles from Baza (see " Unesco Courier ", December 1970) sphinxes, lions, bulls and horsemen. The statue is now in the Museo Arqueologico Nacional, Madrid.

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Lady of Baza (Spain)

Photo © Yuste Publicidad, Buenos Aires, Argentine

SCIENCE AND MYTH

In science fiction we can accept the fantastic and extraordinary because we know they are not true. But in recent years there has been so much talk in the press, on T.V. and elsewhere of robots that "think", computers that have "nervous breakdowns" or "flying saucers" manned by creatures from outer space that such myths are being taken for scientific fact. Science popularization today therefore has an important role to play toward a better understanding of science as distinct from the myths.

SCIENCE AND MYTH

Talk of machines that "think", computers having "nervous breakdowns", "flying saucers" is creating a new kind of myth hiding behind the cloak of science. Here a leading French scientist discusses modern myths in relation to a true understanding and popularization of science.

by Pierre Auger

TO the sensational progress of science—and of physics and biology in particular—what is generally called the general public reacts in three different ways.

Some admire and even wax enthusiastic about the daring exploits of astro-physics and molecular biology. Without being really able to add to their own knowledge, they sense the grandeur of this amazing adventure of the human mind.

Others are struck, above all, by the technical achievements which follow in the wake of scientific progress, such as communications satellites, supersonic flight, and exploration of the moon and of the ocean floor. The power of man equals, and in certain fields surpasses, that of the gods of antiquity.

There is a third attitude, however, which is wholly compounded of the anxiety and distrust inspired by scientific progress and at the same time—perhaps even primarily—by the attendant technical progress. Where are we heading with these machines and computers? Can we be sure that these atomic, space and genetic adventures are not going to end in disaster?

Thus, if the writer on scientific subjects is to cater for every category of reader, he must not take the easy path and be content with tending and feeding the sacred fire of the first group we have described, and with providing fresh grounds for the enthusiasm of the second group. He must take care to reassure the third group, and this he must do by re-establishing the truth, not the truth pure and simple, for the truth is complex and often abstract, but the naked truth by which I mean stripped of the fantastic trappings with which it is all too often embellished by publicists—I dare not call them writers—who are either naive and ill-informed themselves or else unscrupulous popularity-hunters.

There is no denying that this is a very difficult task. It is even regarded as an impossible one by some people of sound judgement who see the attempts of science writers to acquaint the general public with certain fields of knowledge as leading simply to the creation of a new kind of mythology.

I can be quite frank here and admit that they are often right. This is certainly one of the main rocks on which the efforts of those known as popular science writers come to grief. It is a rock never struck by the writers of those works of fiction in scientific garb which fill library-shelves labelled "science-fiction". Here, the creation of myths is the avowed aim.

A word of warning however. It is essential that the mythical nature of such books be clearly indicated so that there is no mistake about what is being offered for public consumption. There has been too much talk of machines that think, computers that get nervous breakdowns and flying saucers with little green men from outer space. From all this there seems to have been born a kind of myth which people are beginning to take as scientific fact.

But let us look at what the popular science writer can do to communicate knowledge instead of new myths. First of all, what distinguishes a scientific theory from a myth?

Here I am using the word myth to signify an explanation or theory of natural or human phenomena and events, like those handed down by tradition in ancient times and those still transmitted in this way by so-called uncivilized peoples following the thought processes of "the savage mind" described by Claude Lévi-Strauss.

These myths make use of figures with human characteristics and animals gifted with supernatural powers, but they also present abstract forces such as Fate or mana, particularly those secreted in certain objects.

The expression "scientific theory" is also used to signify explanations of natural—and, if need be, human—phenomena, and although these explanations do not make use of human figures or animals, they nevertheless attribute specific properties to certain objects which secrete forces and are capable of generating phenomena and bringing about events.

Examples of such objects are magnetized or electrically charged bodies, and radioactive or fissile substances. The analogy is so strong as to cause confusion in some cases and myths then grow up around machines, magnets, high-tension cables and ships. A good example is the cargo-cult that grew up around the steamers bringing wealth to the islands of the Pacific.

I shall be told that the educated public of the developed countries will not fall a prey to such confusion. But it is precisely on this point that I would be tempted to share—if only very partially—the pessimistic opinion I mentioned earlier.

Are we quite sure, in fact, that the information given by the popular science writers is always properly understood in the scientific sense? Is there not a tendency among the general public, or a large section of it, simply to trust the presumably competent dispensers of information and to be content with metaphors and rather vague analogies.

To give an example, it is said quite commonly that space engineers have managed to put a satellite in orbit, or

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PIERRE AUGER, *is a leading French physicist and former Director-General of the European Space Research Organization (ESRO) which he helped to set up. He was head of Unesco's Department of Natural Sciences from 1948 to 1959 and is the author of "Current Trends in Scientific Research", a comprehensive survey of world scientific and technological research published by Unesco in 1961, 3rd edition 1963 (see also article page 11).*

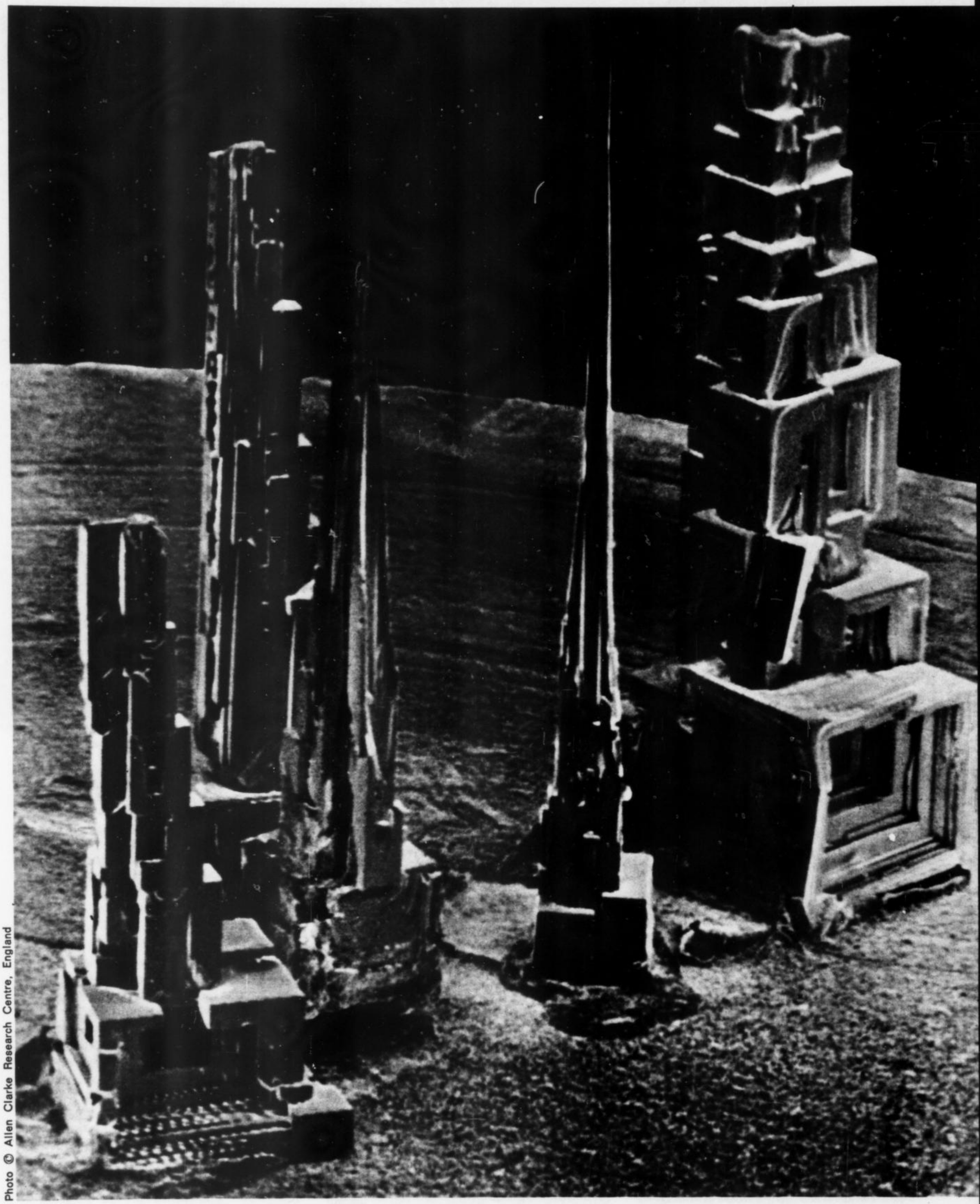

Photo © Allen Clarke Research Centre, England

These soaring spires and towering skyscrapers are not part of a mythical lunar landscape, but anomalous crystals of a lead, tin, telluride alloy, about 2 millimetres high, as seen by a stereoscan microscope. These and similar crystals are used in infra-red lasers and experiments are being made on their use in earth-satellite, satellite-satellite space communication (see also story on Unesco and communications satellites page 21) as well as in blind landing systems for airports.

The legend of the magnetic mountain

Photo from "Hortus Sanitatis", Mainz 1491, Senckenberglache Library, Frankfurt-am-Main, Fed. Rep. of Germany

Magnetism was such a mysterious phenomenon that it gave rise to a whole mythology among the Ancients. The geographer Ptolemy wrote that, near present-day Borneo, there existed mountains "of such great powers of attraction that ships are built with wooden pegs, lest the iron nails should be drawn from the timbers" with disastrous results (left). The legend of the magnetic mountain was repeated in "A Thousand and One Nights" and was accepted as true until early in the 17th century when men such as William Gilbert, "the Galileo of magnetism", laid the foundations of modern theories. Below, the lines of force in a magnetic field as drawn by James Clerk Maxwell in 1865. Iron filings attracted by a magnet (right) form patterns which enable us to "see" the magnetic field. Curious patterns can be built up in this way—in photo right one can imagine the head of an otter or a beaver—and some contemporary artists make use of the properties of magnets in works of kinetic art.

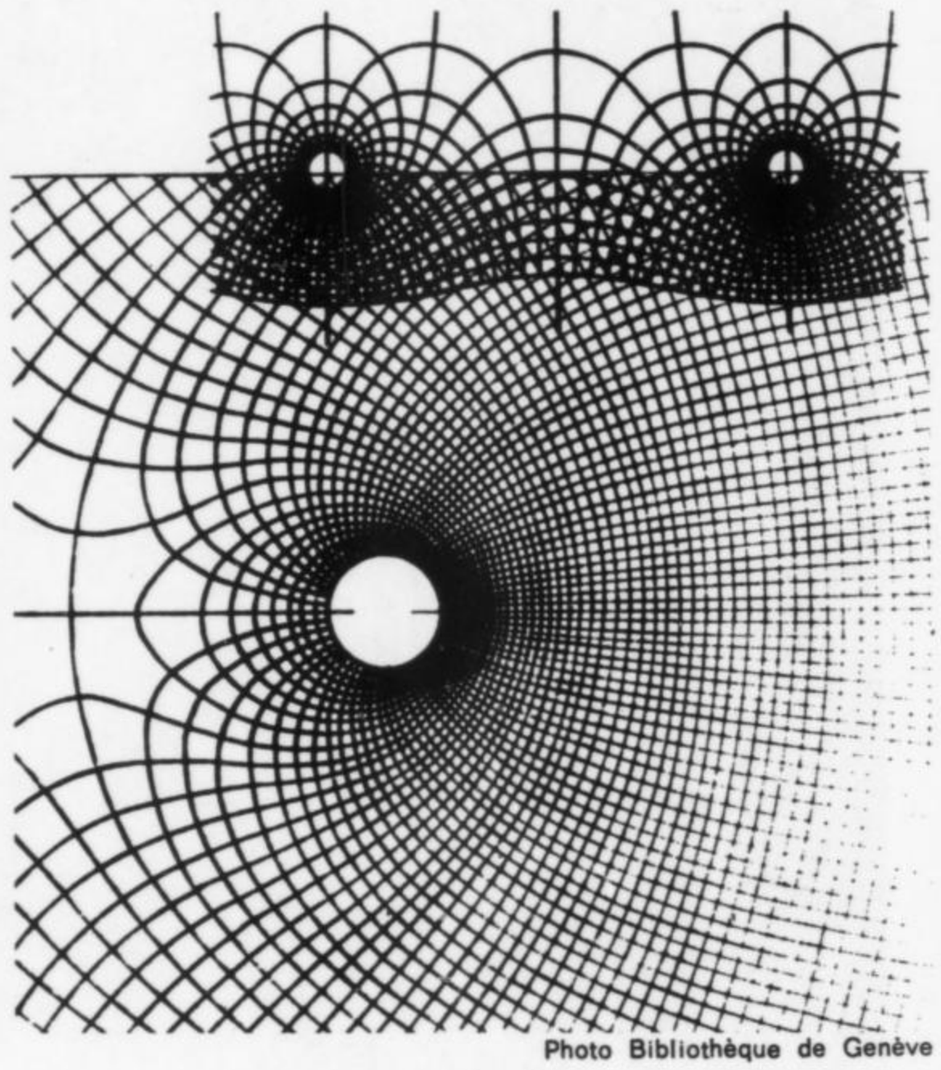

Photo Bibliothèque de Genève

SCIENCE AND MYTH *(Continued)*

that it has gone off its trajectory and fallen into the sea. In this case, it seems clear that the orbit and the trajectory are thought of as abstract objects which the satellite may follow or leave just as a train does the track, or a car the road. This is understandable since we model our conceptions on familiar facts and events.

Unfortunately, the model in this case is a bad one and leads to false ideas about space mechanics. It is perhaps appropriate to use the term myth, in this instance, by comparison with those myths about the planets or the sun in which the heavenly body followed real paths laid down by the gods.

We have another example in radioactivity and radium. A veritable myth had grown up around these glamorous words, and every mineral water and even some beauty creams used to boast of being radioactive, for this was a guarantee of efficacy. We have recently witnessed a spectacular reversal of the myth, since radioactivity is now considered dangerous—because of fallout—and the labels on the mineral water bottles and jars of beauty cream have been surreptitiously brought up to date.

What has to be done, people will say, is to give more detailed information, explain the laws of celestial mechanics, and throw light on the real nature of radioactivity, striking the balance between its benefits, as in the treatment of cancer, and its dangers. They are right of course, and this is what many serious popular science writers are doing, backing up the very effective—and, it must be said, even essential—efforts being made at all levels of the education system.

Only piecemeal improvements will be made in this way, however, when the subjects being dealt with are particularly in the news. A more general strategy must be adopted if we are not to rest content with small tactical victories.

In this connexion, I would like to make a suggestion based on the concept of a "model". A model, which is basically nothing more than the concrete representation of an abstract theory, is a tool for thought—and even for discovery—which is very useful both in making scientific progress and in giving an account of such progress, scientists being no different from other men in the way they think. To make myself clear, I shall draw a parallel between myths and models, and first of all, I shall recall a few facts from the history of science.

Scientists usually take pride in presenting their results in the most perfect and most elegant form, without giving any idea of the gropings, the false starts, and the hard intellectual and experimental work which led up to them.

It is understandable that they should wish not to overburden their writing with details which have ceased to be of current interest. On the other hand, how worthwhile it would be to follow step-by-step the thought and the labour of this or that great discoverer in his exploration of new scientific fields.

In the few cases where this has been possible thanks to an autobiography or a series of published papers, it has made an exciting and instructive study. We can see the part played by models and preliminary plans which are like scaffolding to be removed when the building has been completed.

These models are often concrete ones, sometimes visualized as improvised mechanisms. This was so

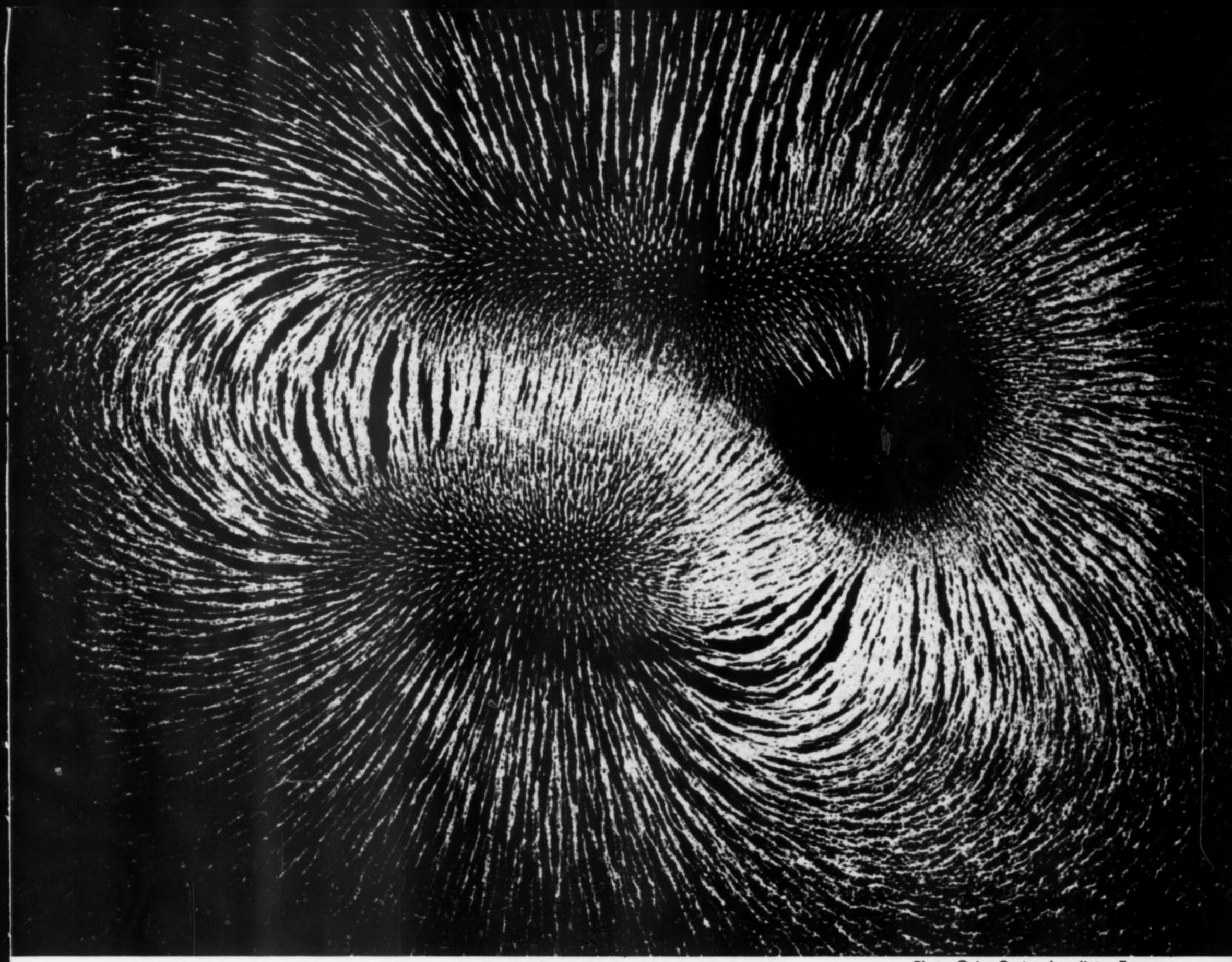

Photo © Le Cuziat, Levallois, France

in the case of James Clerk Maxwell, for example, who had experimented with models of rollers centred on the lines of magnetic force and representing the movements of electricity. Once his equations had been established, all the apparatus was discarded and the equations are now elegant, perfect and abstract. They are also completely incomprehensible to anyone who has not undergone a lengthy initiation.

Many models remain very useful, however, even when the knowledge they represent has been outdated by more general theories. Bohr's planetary model of the atom, for example, still serves quite adequately to interpret many properties of the atom and the molecule. It has the further advantage of being sufficiently visual to be easily accepted by non-specialists.

The even older model of the elastic atoms of the kinetic theory of gases continues to be employed. A great English scientist admitted that he still used it to help him think out his ideas. "When I think of the thermic agitation of the atoms of a gas", he said, "I cannot help seeing little red and white balls knocking against each other." Of course he knew very well that the model was inadequate.

This is the heart of the matter and one of the big differences between models and myths. The model is partial, incomplete and provisional, constructed to be useful for a time (sometimes a very long time!) and then superseded. The myth, on the other hand, is total and definitive from the outset and in this draws close to belief. We shall find other characteristics which carry it at the same time farther away from scientific theory.

But do not theories themselves run the risk of changing into myths if they are treated too much as if they were absolutes? We have the old example of phlogiston which gave metals their sheen and hardness and which resisted the theory of oxidation so stubbornly.

Are we not also justified in saying that absolute time has become a myth still perpetuated by many educated people although it is nothing more than a model which is very adequate on most occasions but must yield to the four-dimensional universe of Minkowski and Einstein.

There is an obvious defence against myths: it is built into the scientific method itself which considers theories good as long as they account for phenomena in the best possible way and especially when they represent a minimum number of arbitrary rules and parameters for a maximum number of facts explained. In the realm of myths, on the other hand, there is one myth for each fact or occurrence to be explained, just as the ancient Romans had a different god for each of life's events, no matter how insignificant.

Here we come to the most sensitive point—the one which is the chief worry, not to say nightmare, of the modern lovers of myth—the touchstone of experiment. A theory, however fine it may be, gives way when confronted with a contradictory fact established by experiment. A myth does not give way but argues, evades and finds often purely verbal loopholes.

This is true of the myth of the waves which are emitted by thinking minds—the thought waves in telepathy—the fluids or waves operative in water-divining, "second sight", extra-sensory perception, and so on. Experimental demonstrations to the contrary have

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no effect on myths and this is an excellent way of distinguishing them.

This is not to say that theories must be immediately confirmed by experiment if they are to be considered scientifically respectable. Experimental confirmation might not come for some time. Researchers will devote all the more effort to this task if the theory has internal logic, is linked with other scientific fields, and synthesizes numerous facts already known, all these being the characteristics of a good theory.

One example is Pauli's hypothesis of the existence of the neutrino, a particle having no mass, no magnetic field, no electric charge and hardly any effect in its passage through matter but which made it possible to restore to their place under the general laws of the conservation of energy and the quantity of movement, absolutely sure experiments lying apparently outside their scope.

"The neutrino is a myth", said some physicists. Experiments have nevertheless shown that it exists, and it plays a fundamental role in nuclear physics. Two or three other hypotheses of this kind are currently being tested, namely the quark, the parton and the intermediate boson. They are good hypotheses which are awaiting the verdict of experiments. They are not myths.

If we wish to explain this to a wide public which is so often impressed by the romantic aspect of the myths we spoke about earlier, and also of the myths concerned with vitalism, vital force and vital impulse, we must lay stress on the quantitative, measurable and calculable aspects of correct theories, as opposed to the resolutely and purely qualitative character of myths.

The rotational force of spiritualists' turning tables has never been measured nor the speed of propagation of telepathic waves and for very good reasons. Calculations of the neutrino's precise energy and velocity (that of light) were made even before it was found and they proved to be correct.

The case of the neutrino is obviously a perfect example. There is no reason, however, why the serious popular science writer should penalize himself by disregarding the fact that all classes of readers are attracted by accounts—sometimes full of the unexpected and even of a kind of romanticism—of the great scientific discoveries and movements, of the opening up of the great avenues of science.

Several books could be quoted which tell of adventures in connexion with the life of a scientist or the development of a school or laboratory, and which are full of memorable anecdotes, some of which have a genuine scientific interest since the real life situations they describe show how scientific thought develops.

What a lot there is to learn from books like these, either for young people attracted towards science or even for the general reader seeking a better understanding not only of the findings of research but also of "how it was done" and how such discoveries are made.

Books like these bring out the rôle of scientific information, in other words, of knowledge of what has already been done, the rôle of the imagination which makes it possible to get out of the rut and discover new paths, and the rôle of chance—or of luck, as some would say—a rôle which has often been grossly exaggerated by sensation-mongering commentators, and "forgotten" by those who have benefited from it.

They are wrong, anyway, for there is nothing more superbly human than the power of the mind to launch a new train of thought from facts or remarks which will be overlooked by people who are incapable of wonder. The classic examples are Henri Becquerel's discovery of radioactivity, the result of choosing a uranium oxide salt as a fluorescent substance, and Donald Glaser's bubble chamber inspired by a glass of beer.

The "personalized" history of science can also be a way of admitting the general public into the laboratory and showing the amount of work, thought, experimental skill and, finally, patience

Photo © Staatliche Museen Preussicher Kulturbesitz, West Berlin

ZEUS, BY JOVE!

Left, Zeus, or Jupiter or Jove, thunderbolt in hand, as depicted on a 5th century B.C. Greek amphora. The Greeks and other ancient peoples believed that the "god of gods" expressed his anger with men by hurling thunderbolts down on earth. It was not until the time of Benjamin Franklin (and his Russian contemporary Mikhail Lomonosov) that this natural phenomenon was linked with the new discoveries being made about electricity. In 1752, Franklin conducted his famous experiment of flying a home-made kite in a thunderstorm (right) to prove that lightning is electricity, which was to lead him to invent the lightning conductor or rod. Far right, an artist's none too serious impression of a possible application of the new invention, drawn in 1778.

The world's first journal devoted to the popularization of science was the "Scientific American" which began publication in newspaper format in August 1845 and later adopted magazine format. Gerard Piel, its present publisher, was awarded the Unesco Kalinga Prize for the Popularization of Science in 1962.

Photo © "Scientific American", New York

Photos Boyer © Roger Viollet, Paris

that underlies great discoveries and breakthroughs. Pasteur defined genius as endless patience and Newton said that he had discovered the law of gravity by thinking about it.

I believe that a great effort must be made to bring people who have never been inside a research institute to appreciate the true value of the work done by all those research workers whose names will never get into the headlines but who make a vitally important contribution to scientific progress.

The danger of presenting the daily life of research workers in this way—particularly on television—lies perhaps in the contrast with the descriptions given in science fiction, which, needless to say, depict only dramatic situations.

There is a risk of taking the poetry out of science—or at least out of research—thus serving the cause of those who place in opposition the famous "two cultures" of Lord Snow (1). To my mind, the remedy lies in the fullest possible integration of all the activities of the human mind and, I should like to add, good taste and sensitivity.

(1) In his book "The Two Cultures", Lord Snow compares humanistic and scientific cultures through interviews with engineers, scientists and men of letters which he uses to show the cleavage between them.

Who is going to write the "Works and Days" of the scientific research worker? Possibly this is asking too much, but it is certainly worthwhile to describe the aspects of science's current values which have a high intellectual and even artistic quality.

One of the characteristics of Science—with a capital S—which has become more and more obvious over the last fifty years is its unity. The general public must realize that in science there no longer exists a juxtaposition of subjects classified according to the order introduced by Auguste Comte or following a less strictly linear order, but instead an immense network of facts and theories forming a pattern from which there emerges the outline of a veritable structure encompassing the whole of nature, from the universe to living beings.

This structure cannot be understood unless it is analysed down to the components of matter and energy, for it is at the level of atoms and molecules that physics, chemistry and biology meet. We must penetrate as far as the nucleus of the atom and its constituent elements in order to add astronomy and cosmology to the other sciences.

Mathematics, of course, are everywhere and our world is indeed the one which Pythagoras had imagined. "All things are numbers", he said, but what would he have thought of the vast field now covered by numbers?

Beginning with the simplest, there is the number 2, following unity and introducing diversity; it might be said to be the atom of diversity from which it is possible to build up the most extreme complexities, just as all the matter of the universe can be derived from the hydrogen atom and the neutron.

Then there are the quantum numbers which are small integral numbers—or half-integral or even third-integral numbers, at the extreme limit—while at the other end of the scale of complexities, the chains of macromolecules of chromosomes offer possibilities of combinations numbering thousands of millions. Here, too, the structure is simple, however, because we need only four symbols to write the great book of the anatomy and physiology of Man! Mathematicians will say that two would be enough, but the chains would then be much longer and perhaps too long to remain stable.

Here, then, are two of the great ideas which are shaping the future development of science: the quest for a structural unity which is no longer just an intellectual need but is gradually becoming discernible and definable and the quest for a complexity which underlies the extreme variety

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Photo Erich Lessing © Magnum, Paris

THE TIME-SPACE CLOCK

Einstein's theory of relativity completely changed man's notions of space and time. Einstein himself wrote, "There are only local times. On earth, for example, everyone is catapulted through space at the same velocity—the velocity of the earth. Thus all the clocks on earth run on equally, and record "earth" time. For a body in motion like the earth, this is its own time... Now when two events take place far away from each other spatially, enormous periods of time are involved. It is no longer possible to say which event took place first and which second. Depending on the velocity of the observer vis-à-vis the event, either answer might be made; and either would be true for a given case."

of beings (or objects) and phenomena in the universe.

The first trend has often been called reductionism, and it cannot be denied that it has been dazzlingly successful, although, it has not led to the discovery of unity in some areas of research, even when followed by geniuses like Einstein. There are still four forces which cannot be expressed in terms of each other and these are the Strong Nuclear force, the Weak Interaction, Electromagnetism and the Force of Gravitation. Nevertheless fresh hopes are raised every day.

The second line of research has recently been extremely successful in the field of biology with genetics and molecular biology, and is gaining ground each day. It holds out the hope that we may come to understand the mechanisms of cellular differentiation, immunity, and perhaps cancer.

The small and, especially, the very big molecules forming the links of the chains of these systems of reaction, catalysis, energy exchange, electrons and protons, are more and more frequently the subject of scientific treatises and articles. They represent a world which is enclosed within the living world but is generally imperceptible.

In fact, until the end of the last century it was virtually only in handling plants that this arsenal of complex and active substances, which composed the pharmacopoeia of antiquity and were also the preserve of the cook, dyer and perfumer, had been recognized and used. Today, as well as these essences and alkaloids, there is a growing list of the proteins comprising the various enzymes and co-enzymes found in this protoplasm which used to be compared to a drop of egg-white!

To bring the non-scientific public to appreciate the value of such research work, we must, of course, highlight the two characteristics of science: knowledge and utility. There must be a better understanding of the world around us, and thus a link-up with the intellectual mission of humanism. People must also learn how this knowledge is used in technical applications and inventions calculated to improve man's lot, so that science is seen in its social rôle. This rôle is not a straightforward one, as the current problems of industrialization show, but knowledge is a prerequisite.

This brings us back to the origin of the three attitudes which we mentioned at the beginning: the beauty, utility and dangers of science. We have to sail a stormy sea, guided by the stars, taking advantage of favourable currents and avoiding reefs.

This is possible only if the crews, ratings as well as captains, retain confidence in themselves, their reason and their vigilance and, like latter-day Ulysses, allow themselves to be led astray neither by the siren voices of all the mythologies nor by the risk of avoiding the Charybdis of Hermetism and the ivory tower only to founder on the Scylla of defoliations and nuclear explosions.

I am not a believer in the religious sense of the word, but I nevertheless think, like the Church, that the greatest sin is despair, and for Man to despair of science and knowledge would be to despair of himself. ■

SCIENCE IS GOOD FOR YOU

An interview with three Unesco science prize winners

by Dan Behrman

IT has become fashionable to decry science or, at least, those unfortunate aberrations of technology that masquerade as science. From his rôle as a latter-day folk hero, the scientist has been transformed by some into a scapegoat for all our present ills.

Funds no longer flow his way with no questions asked, students in many places turn their backs on his calling. Even industrial polluters, like drunkards who promise to take the pledge, are in the front ranks of those who call for a return to the paradise that is supposed to have existed before the Ecological Fall.

In this often-justified furore over what science and technology have done *to* us, we tend to forget what the scientist is doing *for* us. And he had better go on doing it. It is only a privileged minority that can pretend to shunt him aside. The rest of the world needs him more than ever. Wherever men suffer from a lack of the essentials rather than a surfeit of the superfluous, science and its applications have an honourable part to play in human affairs.

Such was the tone of a rather unusual ceremony held in November last year in Paris. Shortly after the close of the 17th Session of the Unesco General Conference, two prizes were awarded by Mr. René Maheu, Unesco's Director-General, in one of the halls that had just been vacated by the conference delegates.

On the rostrum were the three award winners, an Austrian, a Soviet citizen, and a Frenchman—respectively a maker of steel, an explorer of the earth's soils, and a nuclear physicist turned popularizer.

Varied though their backgrounds, origins and interests may appear, they had much in common. They were men

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DAN BEHRMAN *is a Unesco science writer. He is the author of "The New World of the Oceans" (Little Brown and Co., Boston, U.S.A.) also published in a paperback edition, and "In Partnership with Nature: Unesco and the Environment", Unesco, Paris, 1972.*

Photos Unesco - Dominique Roger

Left, Prof. Pierre Auger (France) winner of the 1971 Kalinga Prize for the Popularization of Science. The Unesco Science Prize for 1972 was awarded jointly to Dr. Viktor Kovda (U.S.S.R.) centre, for his research on the "salting" of soil and the use of brackish water for irrigation, and to nine Austrian scientists and engineers, represented by Wolfgang Kühnelt (right) for their development of a new and cheaper way to make steel (the LD process).

with long careers behind them and they shared an optimistic view of the functions and the future of science. Dr. Viktor Kovda, corresponding member of the Academy of Sciences of the U.S.S.R., and Mr. Wolfgang Kühnelt from Austria divided the Unesco Science Prize, each receiving $2,000. At the same ceremony, Dr. Pierre Auger was given the Kalinga Prize for the Popularization of Science, amounting to 1,000 pounds sterling.

The Unesco Science Prize is awarded every two years for achievements of specific value to developing countries. In the past, it has gone to scientists and engineers responsible for better ways of desalting water and growing food.

Mr. Kühnelt accepted his share of the prize in the name of the Austrian group who developed the so-called LD Steel Production Process, a new and cheaper way to make steel, more than twenty years ago. Others in the group cited by the award were Dr. Herbert Trenkler, Dr. Hubert Hauttmann, Dr. Rudolf Rinesch, Mr. Fritz Klepp, Mr. Kurt Rösner, Mr. Otwin Cuscoleca, Mr. Felix Grohs and the late Dr. Theodor Suess.

Of the three prize winners at the Unesco ceremony, Mr. Kühnelt was the only representative of industry. Early in his professional life, he had been an assistant lecturer in an Austrian university. But he preferred the action of a steel mill to the groves of Academe, and now, on the verge of retirement, he is deputy manager of operations of the Oesterreichisch-Alpine Montangesellschaft plant at its Vienna headquarters.

Mr. Kühnelt recalled how, in 1949, Austria was in somewhat the position of a developing nation during the lean postwar years. Steel production was low, only a million tons a year, and it had to be raised.

But the country was short of scrap metal, that essential ingredient in the manufacture of steel. Mr. Kühnelt and his colleagues experimented with a different approach. Instead of blowing air through a molten bath of iron from the sides and below, they sent pure oxygen down onto the surface of their crucible.

It wasn't a new idea to blow oxygen instead of air. Sir Henry Bessemer, the English inventor and engineer had patented it a hundred years ago, but steelmakers believed that the use of pure oxygen would lead to brittleness in steel.

The Austrians were not convinced; they found a way to use the oxygen to get rid of the impurities in pig iron and, at the same time, keep it out of the steel. The method was developed at the plant at Donawitz and also at the Voest works at Linz, hence its name: the LD process.

THE LD process went around the world. In 1952 and 1953, the first LD plants opened in Austria; by 1954 the process was being used in Canada. It was ideal for countries with a small demand for steel. An LD plant could be profitable producing only 500,000 tons a year, as compared to two million tons a year for traditional processes. For once, technological progress did not automatically imply bigness.

Developing countries beat a path to the Austrians' door. Steel men came from India, Peru, Brazil and Tunisia to learn the process, Austrians went to their countries to teach it.

In Tunisia and Peru, the LD process has been combined with continuous casting: that is, the molten steel comes out of the crucible and is cast directly into slabs or billets instead of ingots. The advantage is considerable from the viewpoint of cost. Ingots must go through a blooming mill, slabs or billets are already in a more usable form. Small countries with small budgets need to invest less money in rolling mills.

Speaking in the name of the Austrian steel men who made their first tests with a two-ton crucible (the biggest LD crucible now in use holds 400 metric tons), Mr. Kühnelt let figures do most of the talking. Austrian steel production has gone up from one to four million tons. In 1954, total world steel production amounted to 223 million tons; seventeen years later in 1971, the LD process was accounting for 250 million tons, or 41 per cent of world steel output that year.

The LD process was born out of economic necessity. Equally practical considerations led to the research that also brought the Unesco Science Prize to Dr. Viktor Kovda. A former head of the Science Department at Unesco, he is now director of the Institute of Agrochemistry and Soil Science of the U.S.S.R. Academy of Sciences and he holds the chair of soil science at Lomonosov State University in Moscow.

Of particular relevance to the developing world has been in research on the "salting" of soil through faulty irrigation methods and on ways to reclaim it while, at the same time, using brackish water for growing crops.

DR. Kovda too can recall how his research started. In 1936 and 1937, he was carrying out field studies on Uzbehistan's biggest cotton farm, Pakhta Aral ("Cotton Island"), where 10,000 hectares (25,000 acres) were under cultivation on the "Hungry Steppe". At that time it was thought that water containing more than one gramme of dissolved mineral salts per litre (seawater has an average of 35 grammes) was unsuitable for irrigation.

Dr. Kovda wanted to find optimal conditions for growing high-quality cotton. To his surprise, tests showed that the best cotton was not produced with water of low or no salinity. Instead, it flourished with a soil-water solution of as much as 5 to 6 grammes of salt per litre. Even when irrigated with water twice as brackish, the cotton could still survive.

In the Fergana Valley, that Dr. Kovda likes to refer to as the "paradise of Uzbekistan", the old farmers knew they could irrigate with brackish water. It meant growing salt-resistant crops and irrigating more fre-

20 winners of the Kalinga prize

1952 Prince Louis de Broglie (France)
1953 Sir Julian Huxley (U.K.)
1954 Waldemar Kaempffert (U.S.)
1955 Augusto Pi Suner (Venezuela)
1956 Professor George Gamow (U.S.)
1957 Lord Bertrand Russell (U.K.)
1958 Dr. Karl von Frisch (Fed. Rep. of Germany)
1959 Jean Rostand (France)
1960 Lord Ritchie Calder (U.K.)
1961 Arthur C. Clarke (U.K.)
1962 Gerard Piel (U.S.)
1963 Jagjit Singh (India)
1964 Dr. Warren Weaver (U.S.)
1965 Dr. Eugene Rabinowitch (U.S.)
1966 Paul Couderc (France)
1967 Sir Fred Hoyle (U.K.)
1968 Sir Gavin de Beer (U.K.)
1969 Dr. Konrad Lorenz (Austria)
1970 Dr. Margaret Mead (U.S.)
1971 Dr. Pierre Auger (France)

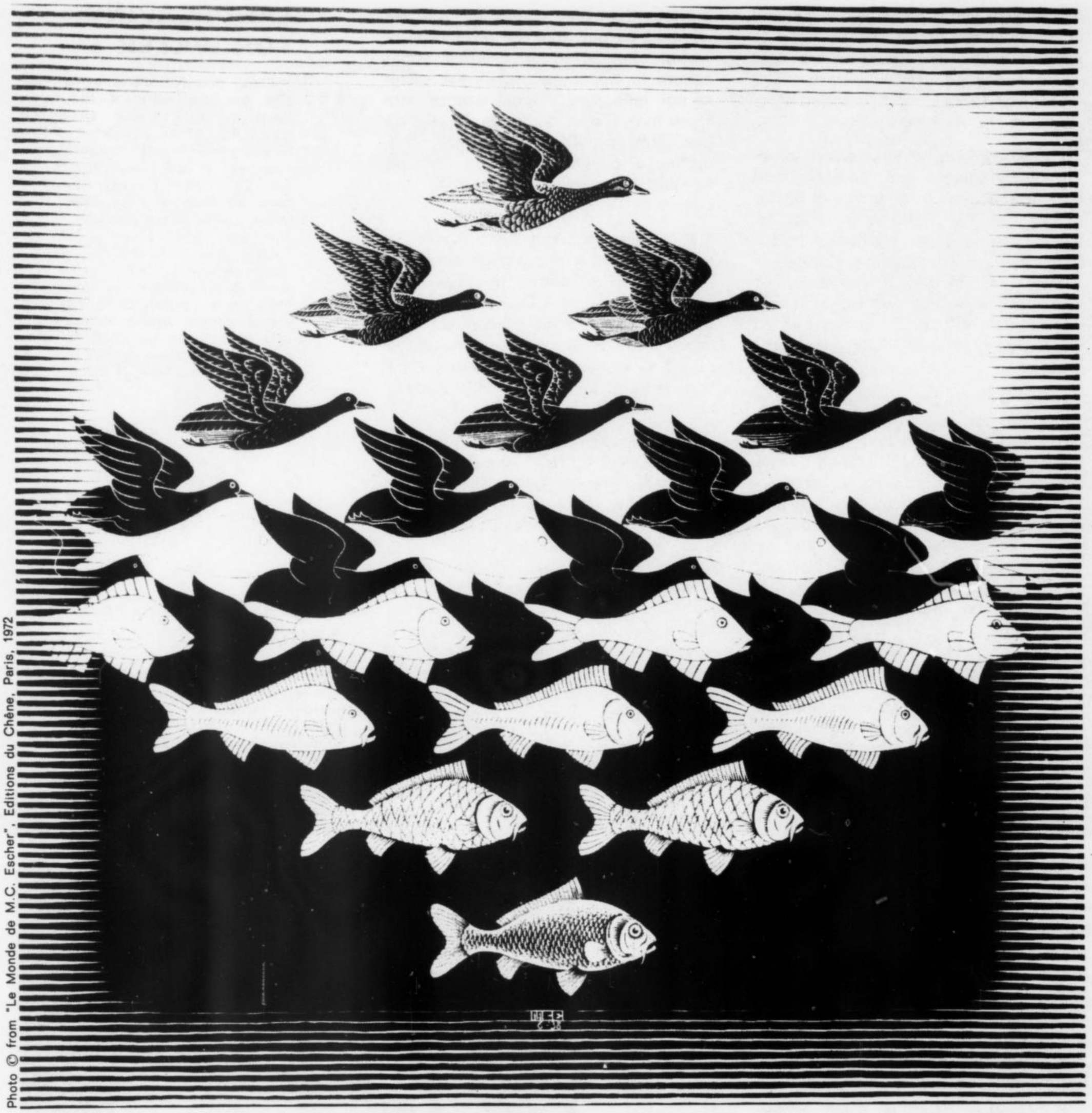


Photo © from "Le Monde de M.C. Escher", Editions du Chêne, Paris, 1972

FISH OR FOWL, OR BOTH?

A shoal of fish imperceptibly becomes a flock of birds in this 1938 print by Maurits Cornelis Escher, a Netherlands engraver, whose drawings and prints have been widely reproduced in scientific books and articles (See "Bookshelf", page 33). The design was used by Ivan Rosenqvist, a Norwegian geologist, to demonstrate the particular characteristics of two substances: clay and water. The centre line of the print represents the meeting point between particles of clay (birds) and molecules of water (fish). The further the birds (clay particles) move upwards from the centre the more freely they fly. As the fish (water molecules) recede from the clay particles they too can move more easily.

quently on well-drained land so that the salts could be flushed out of the soil. All this information was interesting but mainly academic because, in those days, the U.S.S.R. had an adequate supply of low-salinity river water.

Then, in 1957, Dr. Kovda was sent by his government as an expert to the Arab Republic of Egypt. There, he saw water as a truly scarce asset. Underground water with 5 to 7 grammes of salt per litre—usually considered a lethal dose for soil—was being used to irrigate oases that had remained productive for two or three millennia.

The following year, he joined Unesco and visited Tunisia where the same problem existed. Food had to be grown but only brackish water was available to grow it. With the support of President Habib Bourguiba of Tunisia, he proposed that an experimental station be set up in the country to test irrigation methods.

That was a decade ago. Today the work done in Tunisia under the United Nations Development Programme has shown how the great underground sea

CONTINUED NEXT PAGE

of brackish water lying below the arid lands of North Africa can be used to support crops and trees where only rocks and sand existed before. The lessons of Tunisia can be applied elsewhere in the developing world.

Dr. Kovda has organized the preparation by Unesco and the U.N. Food and Agriculture Organization of an International Source Book on Irrigation and Drainage of Arid Lands ("Irrigation, Drainage and Salinity", to appear shortly). He himself is the author of some 350 scientific works, including ten books and he is now active in Unesco's Man and Biosphere programme.

Yet one might say that this all began some fifty-odd years ago when a small boy read the adventure stories of Jules Verne, Mayne Reid and James Fenimore Cooper. Young Viktor Kovda wanted to be an explorer. He and his brother built a boat and roamed the rivers around their home just as Tom Sawyer and Huckleberry Finn did in the books of another of his favourite authors, Mark Twain.

When he entered the University of Krasnodar in 1927, it was a time of scientific growth in his country. He was enamoured of science, but he clung to his first love of exploration. Soil science allowed him to be true to both. Even as a student he carried out soil surveys in the field. His professors had taught him the romance of the earth.

Almost fifty years later, the romance is still there. When Dr. Kovda accepted the Unesco Science Prize, he spoke of our mother earth and how she can punish us severely with drought, floods, earthquakes, volcanic eruptions. We dare not sit back and merely contemplate nature, he said. "Only if we change nature with care will she bear fruit—and we need not preserve her virginity for future generations."

But mother earth is 5,000 million years old, said Dr. Kovda, and she has not had an easy life. We must rejuvenate her. Twenty per cent of the earth's land surface is absolute desert and 40 per cent is arid or semi-arid. If this land could be brought into production by irrigation, it would yield food... but not only food.

Photosynthesis would be taking place over a vast area that is now sterile. Plants would be using the energy of sunlight to manufacture carbohydrates, taking up carbon dioxide in the process and releasing oxygen.

Dr. Kovda reminded his audience that certain industrial areas already show an oxygen deficiency, producing less than they consume. And we all know by now that the proportion of carbon dioxide in the earth's atmosphere is steadily rising as the result of our holocaust of coal and oil, the fossil fuels. In other words, Dr. Kovda has proposed that we organize a cycling of oxygen and carbon dioxide by putting a plant cover over the desert.

It is precisely the function of the scientist to think along such bold new lines when confronted by apparently insoluble problems. Dr Kovda's hopeful assessment of the contribution that science can make to the future of the planet was shared, in the main, by the third speaker on the rostrum at Unesco House.

At seventy-three, Dr. Pierre Auger is the oldest of the award winners, but he is a remarkably young man in spirit. This is probably because he has led a series of lives, first a twenty-year career in the laboratory as a cosmic-ray physicist, then an almost equally long "life" as director of higher education in France after World War II, head of science at Unesco, and director-general of the European Space Research Organization. And now, in an extremely active retirement, he is continuing his work as a popularizer of science, writing articles and making radio broadcasts to answer the questions of a worried public.

Dr. Auger did not grow up in the

LANDSCAPING FOR WATER

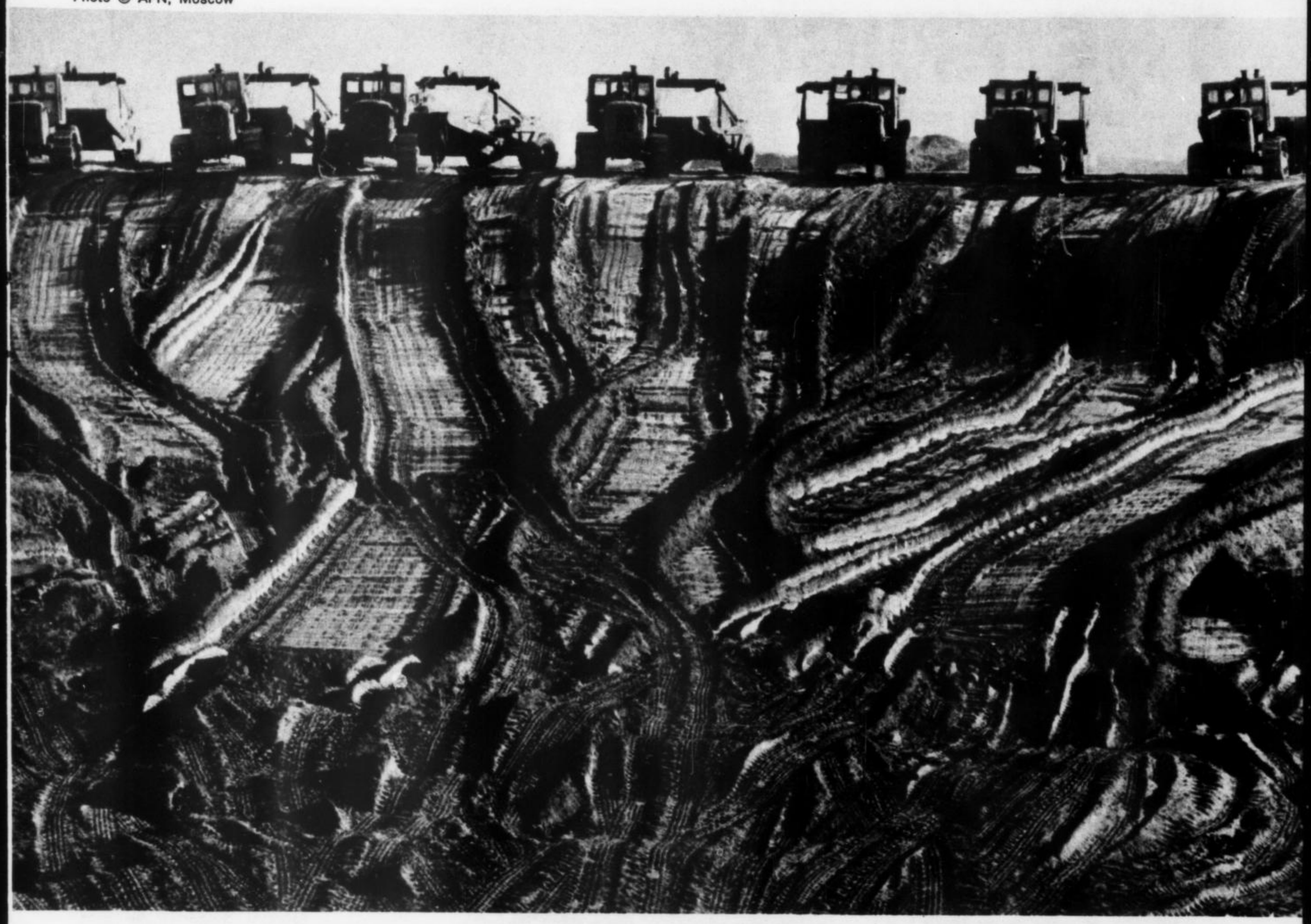
Right, massive earthmoving vehicles line the bank of the future canal in southern Uzbekistan (U.S.S.R.). When completed in 1975 it will provide water to irrigate a vast area of arid land. In Uzbekistan, Dr. Viktor Kovda, winner of Unesco's Science Prize, noted how farmers used brackish water to irrigate their land. Later, in southern Tunisia, he proposed the use of similar methods. Since then a U.N. research programme has shown how the great underground sea of brackish water below North Africa's arid lands can be used to grow crops and trees—a lesson that can be applied elswhere in the developing world.

SPARKING A STEEL REVOLUTION

For developing a revolutionary new process of steel production a group of nine Austrian researchers was awarded the Unesco Science Prize in November 1972. Photo shows one phase of this production technique—the LD process—in which pure oxygen is blown onto the surface of the crucible. The LD process, a cheaper and more efficient way to make steel, is now used in all parts of the world.

Photo © BOT, Linz, Austria

Photo © APN, Moscow



countryside as young Victor Kovda had done. His father was a professor of chemistry at the Sorbonne; his home was steeped in science. The Augers decided to give their son more than an ordinary education in science. With several other Sorbonne scientists, they formed a "community" to teach science to each others' children.

Jacques Hadamard, a great French mathematician, taught Pierre Auger mathematics and geology. His father had given him chemistry and his own interests had led him to enter the Ecole Normale in Paris as a biology student at the age of nineteen. There, he came under the influence of Jean Perrin and his son. The elder Perrin later won a Nobel Prize in physics while Francis, his son, became the head of the atomic energy establishment in France. Pierre Auger was converted to physics, but he already had an interdisciplinary view of the sciences that has never left him.

This made it all the easier for him to project science beyond the bounds of his profession and bring it within the grasp of the general public. "The public has a false idea of science", he has said. "It sees dangers where none exist; it does not see them where they are really present. Atomic energy is feared but it can be controlled. There is much less concern over the demographic explosion yet, so far, we do not know how to control it."

While carrying on his scientific work, Dr. Auger wrote and broadcast regularly for the public. He had over 300 articles published in *Lectures pour Tous*, a large-circulation French magazine, and he helped bring science into the programmes of the French Radio and Television Service. It was for this aspect of his career that he was awarded the Kalinga Prize for the Popularization of Science, founded in 1951 by an Indian industrialist, Mr. Bijoyanand Patnaik, and administered by Unesco.

When he accepted the prize at Unesco House, Dr. Auger discussed the responsibilities of the scientific popularizer and, at the same time, the attitude of the general public towards science (see article page 4.) Some members of the public are enthusiastic about the intellectual adventure of basic science, others want to hear of the feats of technology, but there is a third category that looks upon science with anxiety. The first two require mainly food for thought, said Dr. Auger, but the third should be given the unvarnished truth without dramatic trappings.

What the popularizer must do at all costs is to transmit knowledge rather than create myths. Dr. Auger made a case for the humility of science that seeks truth by building a theory or model, then testing it by experiment. The mythmaker, on the contrary, explains events by bestowing superhuman virtues upon objects. The test of a scientific theory is its universality, but this does not concern the mythmaker who can invent a new explanation for every new event just as the Romans had a god for every phenomenon.

Dr. Auger observed that all barriers between disciplines are now down—just as they were in that scientific "community" of his childhood. The unity of structure of the universe is becoming apparent, we can understand the stars only if we can understand the atom and nuclear energy. Even science and art are drawing closer. The hope of science lies in this universality. ■

THE ENIGMA OF THE THRACIANS

Tomb discoveries on the plains of Bulgaria shed new light on a civilization of hunters and goldsmiths dating back 3,000 years

Right, a hunting scene decorating part of a link from a Thracian silver-gilt belt of the 4th century B.C. The chase figures prominently in the decorative art of the Thracians, who were great horsemen and hunters. Unearthed near Letnitsa (central Bulgaria) the complete belt link is inset with pearls forming three panels. In this one the archer's conical cap and fringed tunic and the attitude of the horseman urging his mount to jump recall similar figures discovered in Persia. The Thracian craftsman who made the belt during the 4th century B. C. may have drawn inspiration from Achaemenid art of the same period. Left, a silver knee-piece embellished with a human face (350-300 B.C.) found in a Bulgarian burial mound at Vratza. When pursuing dangerous game such as wolves and bears, Thracian hunters wore protective armour including knee-pieces of this type.

Photos © Sofia Press, Bulgaria

by Magdalina Stancheva

THE Thracians and their culture pose one of the most fascinating enigmas in the early history of Europe. Today their ancient territories lie within the frontiers of Bulgaria, Greece and Turkey-in-Europe; and though the Thracians bequeathed their cultural heritage to Europe, they were bound to Asia by strong and abiding links.

Mention of the Thracians may bring to mind the name of Spartacus, who led a great slave uprising against ancient Rome, or passages from Homer's *Iliad*. It may also conjure up an image of gold treasures or of a region in south-eastern Europe.

As early as the 13th century B.C. the Thracians crossed the narrow strip of water separating them from Asia Minor and indisputable traces of their presence have been found in the earliest archaeological layers at the site of Troy. In this way they occupied areas of contact between the two continents and remained open to influences from both East and West.

Answers to some of the mysteries surrounding the Thracians are today being found in the burial and settlement mounds that dot the Bulgarian landscape. Archaeologists excavating the many cultural layers of the settlement mounds have uncovered strata dating back to the Neolithic and Bronze Ages and found apparent evidence of links with Thracian and pre-Thracian tribes. Much painstaking work remains to be done, however, before it is possible to determine the date from which the inhabitants of these settlements can be considered with certainty as Thracians.

Altogether, over 15,000 mounds have been charted and listed by Bulgarian archaeologists and are now protected by law as important cultural relics. What do they hide? Some may be princely tombs rich with priceless vessels and jewellery; others may be soldiers' graves, containing merely an urn full of ashes and a bent iron spear. There is work enough for generations of archaeologists.

But it is not always the biggest mound that conceals the most valuable treasure. Two years ago, during the construction of a canal near Sofia, the scoop of a mechanical shovel bit deep into a slight rise in the ground and brought up in its load of earth a clay urn, a copper cauldron and a huge gold bowl. With its exquisite shape and ornamental flutes and spirals, the gold bowl, dating back to just over one thousand years B.C., was clearly the work of a skilled goldsmith.

Prior to this discovery the only known gold vessels from this period of Thracian history were those found near the village of Vulchitrun, in northern Bulgaria, and known as "The Vulchitrun Treasure". More than 14 kilogrammes of gold had gone into the making of these vessels of various shapes and sizes, which it seems were intended for ritual use, possibly in connexion with sun-worship.

From about 500 B.C. the Thracian principalities flourished, and many of the Thracian tribes united to form the powerful kingdom of Odrysae. They traded with Greece and with the Greek colonies established along the shores of the Aegean and the Black Sea. Greek influence made itself felt among the ruling classes. But it was a two-way traffic and Thracian culture in turn left its imprint on the arts and crafts and even the cultural life of the Greeks.

One example of this was the spread of the cult of the god Dionysius which was rooted in Thracian religion. Another is the tragic story of the legendary Thracian poet and musician, Orpheus, which became a familiar theme in Greek and Roman poetry.

In those prosperous times, Seuthopolis, the capital of the kingdom of

CONTINUED PAGE 20

MAGDALINA STANCHEVA *is one of the leading archaeologists and philologists of Bulgaria. Head of the Archaeological Department of the Historical Museum in Sofia for the past twenty years, she has carried out investigations at all the major archaeological sites in her country. For her pioneer work on Serdica (the ancient name for Sofia) she was recently awarded the Sofia Prize.*

Photo © Sofia Press, Bulgaria

THREE-HEADED SERPENT

This three-headed serpent, left, of the fabulous beasts that de silver-gilt plaques, dating back 4th century B.C., found at th lage of Letnitsa, northern Bu Other plaques bear scenes of day life. Measuring between 8 cm., each plaque has a ring back by which it was attach the straps of a horse's ha

OLDE GOLD

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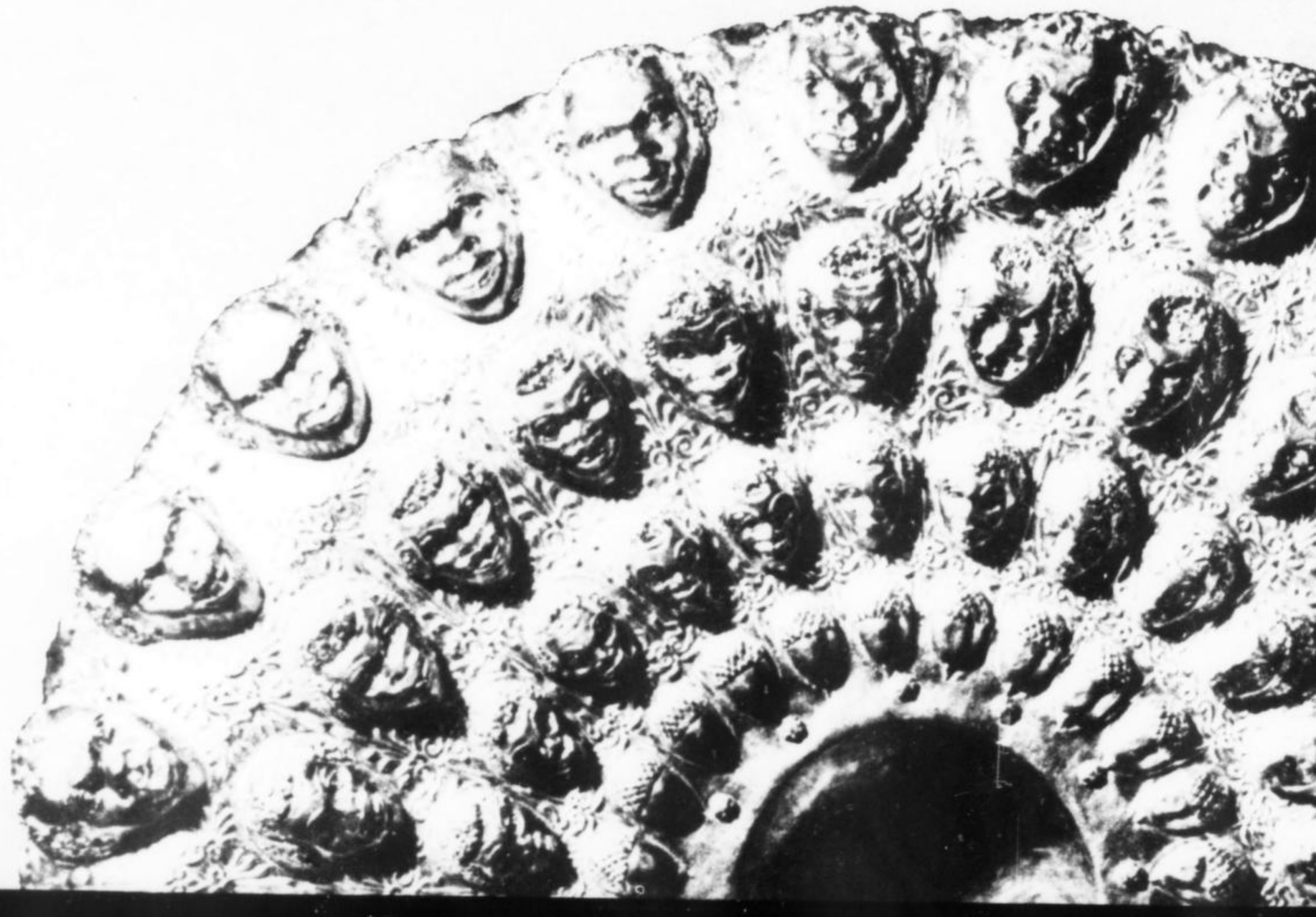

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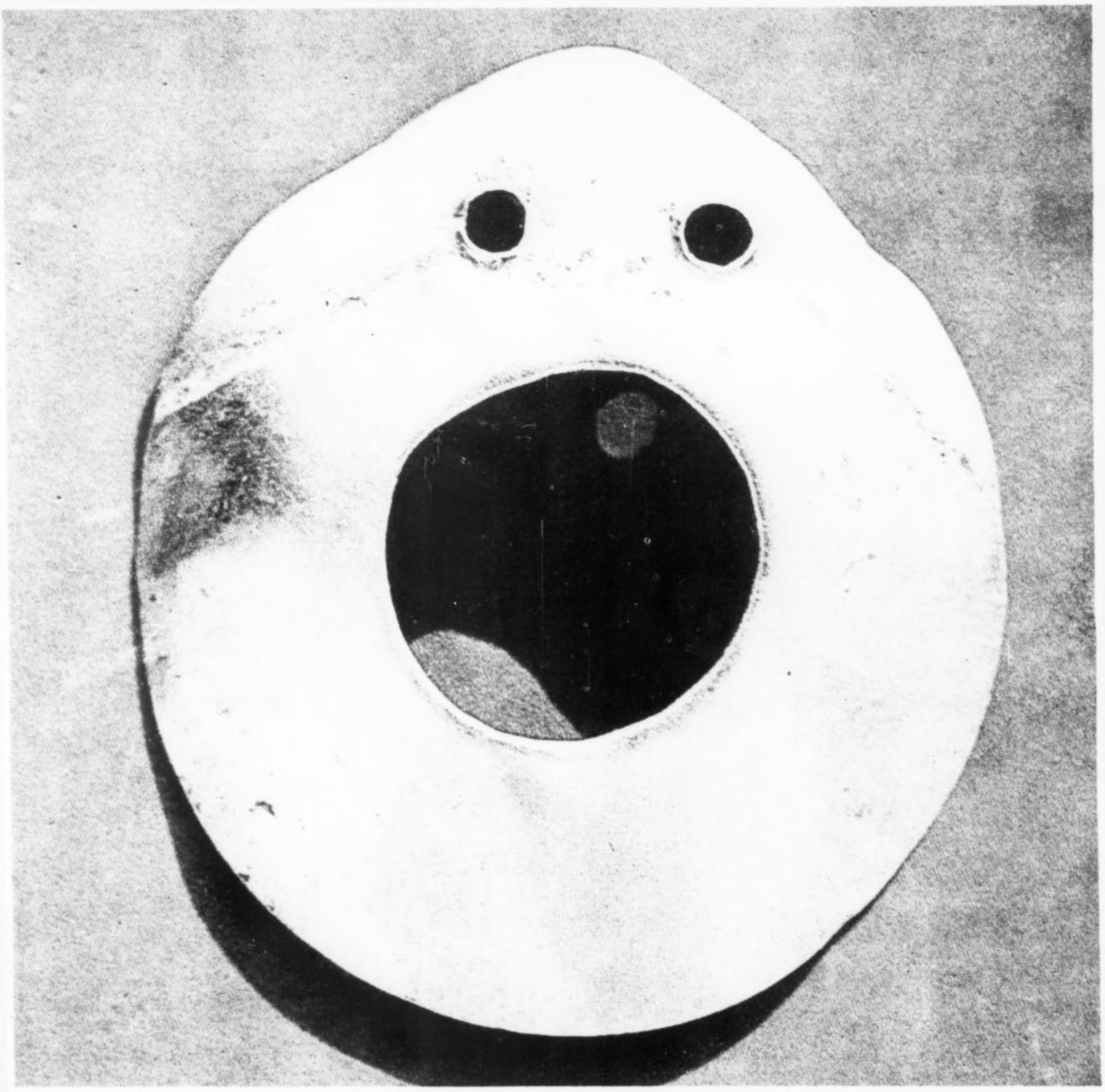
Photo © Sava Boiadjiev, Sofia, Bulgaria



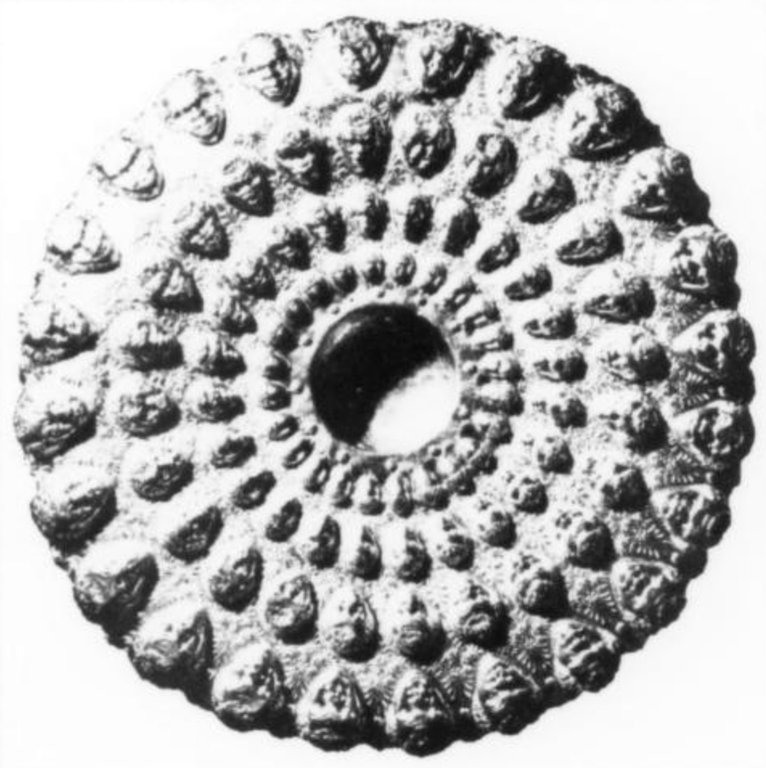
LDEST BULGARIAN OLD TREASURE

ting back to before 2000 B.C., the oldest d treasure yet found in Bulgaria consists a cache of 44 rings found at Khotnitsa, novo district. Archaeologists are puzzled these curious objects, made of solid gold d polished on one side only. Some nsider them to be idols, the two smaller es representing the eyes and the larger, ntral hole the mouth; others think that they re ornamental medallions suspended by ngs threaded through the smaller holes.

LIBATION BOWL

One of the finest items in the treasure trove discovered at Panagyurishté, 70 km. south-east of Sofia, is this 4th-3rd century B.C. gold libation bowl. Detail left shows the outside of the bowl richly decorated with three concentric circles of negro heads and a circle of acorns. These motifs are repeated on the inside of the bowl. Photo below shows complete bowl (measuring 3.5 cm. high by 25 cm. across) which was fashioned by craftsmen of Lampsakos, one of the Greek colonies that flourished on the coast of the Sea of Marmara.

Photo © Sofia Press, Bulgaria



Odrysae, named after its ruler Seuthes, was built on the model of the Greek towns in the valley of the river Tundja. Here, where the king's palace was built, archaeologists found an inscription in Greek giving the name of the town, among the ruins that had lain undisturbed for centuries beneath the soil of the Valley of the Roses.

Two other magnificent examples of Thracian art were also discovered in the Valley of the Roses: the Panagyurishté treasure and the Kazanluk tomb, burial place of a Thracian chieftain.

The Kazanluk tomb is a small building with a narrow passage and a round chamber covered with a cone-shaped dome (see "Unesco Courier", June 1968). The walls are covered with some of the most perfect paintings in Europe, the finest to come down to us from the fourth century B.C.

In the centre is depicted the classical scene of a funeral feast with the chieftain and his wife seated at a well-laden table. The wife has placed her hand in that of the Thracian prince, her head is bent, her exquisite face expresses grief at the parting. Around them are servants bringing gifts, and leading the dead chieftain's favourite horses. The atmosphere of solemnity is softened by these touches of intimacy. Up above, in the dome, four-in-hand chariots are being raced.

The paintings reveal the hand of a highly trained and skilful artist, possibly a Greek, but the spirit and the content of the scenes depict Thracian customs and the life of a princely Thracian home.

The set of gold wine vessels, or rhyta, found near Panagyurishté is another example of the penetration of Greek art. The rhyta are made in a variety of forms: the heads of women or animals, amphoras with mythological scenes, the forequarters of a goat. The flat cup (Phiale) is ornamented with concentric circles of small negro heads in relief (see photo page 19).

This exquisite work was made in the city of Lampsakos on the coast of Asia Minor.

Many other masterpieces have been unearthed in recent years and named from the places where they were found: the Loukovit, Letnitsa, Vratsa and Stara Zagora treasures. Gold or silver, they were almost all made by Thracian goldsmiths.

Many of the objects found in tombs were made to ornament the trappings of horses, for Thracian funeral customs included the burial of the dead man's horse in the same mound. A Thracian warrior's proudest possessions were his horse and the arms he bore, and their decorations were true works of art.

Figures of animals usually formed part of the decoration. Skilful stylization transformed their strained and contorted bodies into intricate entwined ornaments—extraordinary combinations of four-footed animals, birds and reptiles.

This art, which was possibly alien and incomprehensible to the Greeks, was the product of centuries of development, during which its forms attained a remarkable degree of stylization, without, however, losing their initial traits. Some researchers have recently looked for the sources of this art in pre-Achaemenid Iran, where new finds from Luristan show interesting similarities with those of Bulgaria.

Man, the warrior and mounted hunter, is the main subject of the decorative plaques found near the village of Letnitsa. In contrast to the animal forms, the human figures appear rather stiff and clumsy. The engraver shows little concern for proportion, but carefully records details of the chain-mail and weapons, and notably the face, which is large and expressive. Human and horses' heads, unconnected with the rest of the composition, are boldly placed in the spaces around the figures.

THE variety and abundance of finds in the tombs is linked with the Thracian attitude towards death. The Greek historian, Herodotus, (5th century B.C.) described the Thracian custom of lamenting over a new-born baby, but of bidding farewell to the dead with feasting and merrymaking. This attitude to life and death must have expressed the hardships of everyday life, which led the Thracians to the ritual rejection of life and to the concept of death as a deliverance.

Having become a deeply-rooted tradition, this attitude accounts for the extraordinary magnificence of the funerals of the rich. No less than five richly adorned chariots together with the horses required by the ritual were found buried near the tomb of their master in a mound not far from the town of Stara Zagora.

In the early years of our era the hand of Roman rule was laid heavily on this martial and freedom-loving people. The prolonged resistance to Roman conquest was marked by acts of desperate courage, which we learn about from Roman authors. Far from his native land (today in south-western Bulgaria) Spartacus the Thracian became the leader of the greatest rebellion of slaves in history.

But in time many Thracians joined the Roman army and administration, while the nobles preserved their privileges and their estates, as inscriptions on the Thracian villa-castle near Stara Zagora and burial finds of the Roman period affirm.

Yet the spirit of Thracian culture survived, and although luxurious temples to the gods of the Graeco-Roman Pantheon were built, shrines of Heros, the Horseman, the beloved and most honoured Thracian deity, are still found scattered over the Thracian lands.

Like his worshippers, Heros was a hunter and warrior. He is associated with the powers of life as well as the underworld and he was the god of both fertility and death. Bendis, the forest huntress, who is identified with Artemis-Diana, the huntress, is Heros' feminine incarnation.

In the following centuries the Thracians had to endure the invasions of the Goths, the Visigoths and the Huns. They withdrew many times to the hills and again returned to the ravaged plains, into which, in the sixth century, the Slavs gradually penetrated and settled. They were the last wave of the Great Migration of the Peoples. The surviving Thracians merged into the new ethnic community formed here by the Slavs and the Proto-Bulgarians.

Today, after 1,300 years, a distant echo of the Thracian past is still heard in Bulgarian folklore, in those special features which distinguish it from the folklore of the other Slav peoples, and which are rooted in the ancient history of present-day Bulgaria. ■

A lovely example of Thracian art, this 16 cm. high, stylized stag of the 7th century B.C. was found at Sevlievo (Bulgaria). The points of the antlers are carved in the form of birds' heads.

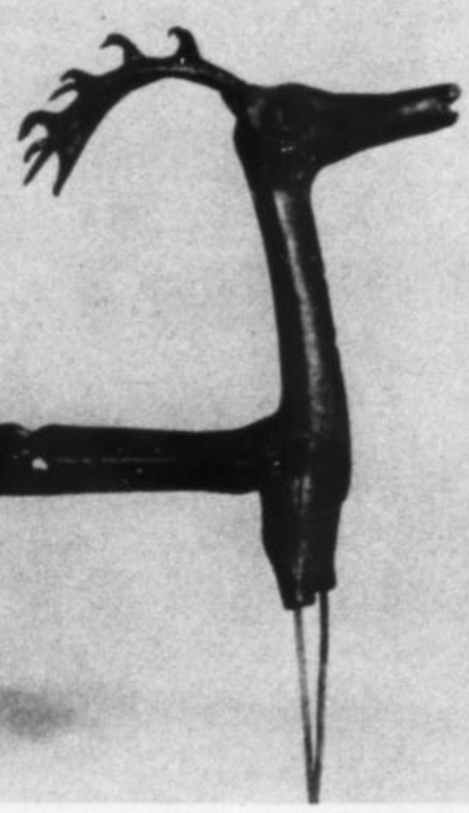
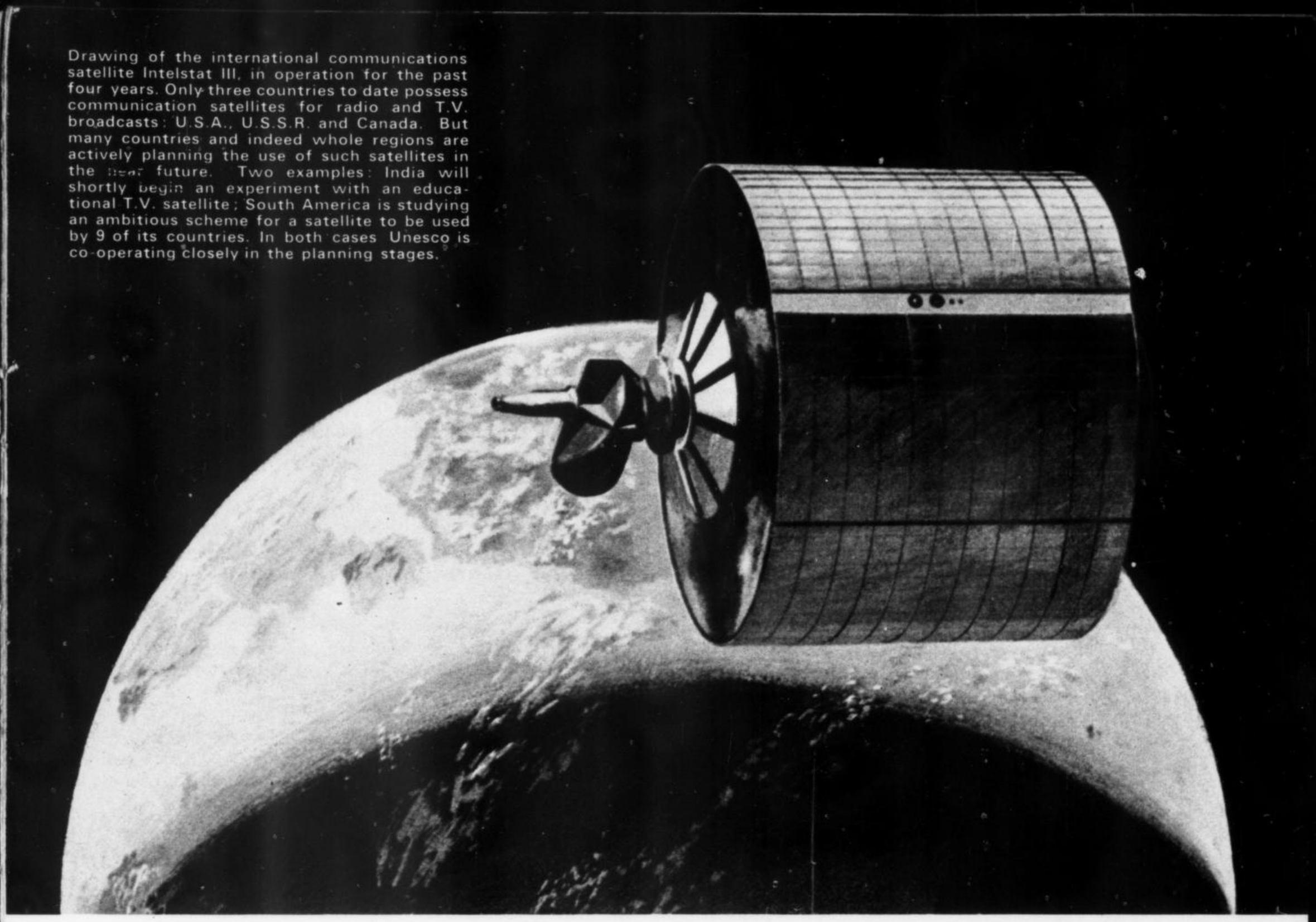


Photo © Sofia Press, Bulgaria



Drawing of the international communications satellite Intelstat III, in operation for the past four years. Only three countries to date possess communication satellites for radio and T.V. broadcasts: U.S.A., U.S.S.R. and Canada. But many countries and indeed whole regions are actively planning the use of such satellites in the near future. Two examples: India will shortly begin an experiment with an educational T.V. satellite; South America is studying an ambitious scheme for a satellite to be used by 9 of its countries. In both cases Unesco is co-operating closely in the planning stages.

Drawing © from "Satellite Communications", Kokusai Denshin Denwa Co., Ltd., Tokyo

INTERNATIONAL PROBLEMS OF TELEVISION VIA SATELLITE

A major debate at Unesco's recent General Conference

by
Gunnar Naesselund

GUNNAR NAESSELUND *is Director of Unesco's Department of Free Flow of Information and Development of Communication. Before joining Unesco he was Managing Director and Editor in Chief of "Ritzaus Bureau", the Danish national news agency. He has been deputy chairman of the International Press Telecommunications Council and was formerly a lecturer at the school of journalism at Aarhus University (Denmark).*

THE satellite broadcasts of tomorrow became the focus of the debate on communications at Unesco's seventeenth General Conference in Paris in October-November 1972, almost ten years to the day after the first authorization given by the General Conference to the Director-General to undertake studies of the consequences which new techniques of communication by artificial satellites might have on the achievement of Unesco's objectives.

A series of studies, meetings and negotiations culminated in a "Declaration of Guiding Principles on the Use of Satellite Broadcasting for the Free Flow of Information, the Spread of Education and Greater Cultural Exchange", setting out in a Preamble and eleven Articles principles for guidance of member states in the use and development of this new technology.

The guidelines were finally adopted at the General Conference by a large majority, but the debates—as well as the voting figures—revealed a conflict of views which will not be easily reconciled.

The deepest of these is the basic issue of freedom of expression. Another is the authority of organizations

CONTINUED NEXT PAGE

A declaration of 11 'guiding principles'

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2 **Satellite broadcasting shall respect the sovereignty and equality of all States.**

Satellite broadcasting shall be apolitical and conducted with due regard for the rights of individual persons and non-governmental entities, as recognized by States and international law.

3 **The benefits of satellite broadcasting should be available to all countries without discrimination and regardless of their degree of development.**

The use of satellites for broadcasting should be based on international co-operation, world-wide and regional, intergovernmental and professional.

4 **Satellite broadcasting provides a new means of disseminating knowledge and promoting better understanding among peoples.**

The fulfilment of these potentialities requires that account be taken of the needs and rights of audiences, as well as the objectives of peace, friendship and co-operation between peoples, and of economic, social and cultural progress.

5 **The objective of satellite broadcasting for the free flow of information is to ensure the widest possible dissemination, among the peoples of the world, of news of all countries, developed and developing alike.**

Satellite broadcasting, making possible instantaneous world-wide dissemination of news, requires that every effort be made to ensure the factual accuracy of the information reaching the public. News broadcasts shall identify the body which assumes responsibility for the news programme as a whole, attributing where appropriate particular news items to their source.

6 **The objectives of satellite broadcasting for the spread of education are to accelerate the expansion of education, extend educational opportunities, improve the content of school curricula,**

within the U.N. family to deal with these questions. On the one hand are the fears of developing and other nations of being exposed to unwanted programmes, over which they have no control. On the other are the obvious benefits which individual countries could gain from having access to programmes, which would promote the exchange of ideas and knowledge.

All these issues are interrelated and, in part, contradictory, which in itself explains the complexity of the problem and the conflicts which emerged during the General Conference debate.

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One such installation constructed in the United States, will be used experimentally to pick up full colour television programmes from the NASA experimental satellite ATS-F, which is expected to be launched early in 1974.

The cost of these units will be about two thousand dollars each, for an order of 300—one for each of the sites selected for the experiment. Manufacture in large quantities may halve the price. Later on the same satellite may be used for similar purposes over India for a one-year experiment in about five thousand villages.

The United Nations Committee on the Peaceful Uses of Outer Space is the focal point within the U.N. family for co-ordination of the U.N. activities in this sphere and has been kept informed throughout of progress in the preparation of the Unesco Declaration, but has not yet been able to comment. It is expected to do so soon when two of its organs may have the text of the Declaration on their agenda.

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A number of industrially developed countries, including the United States, Australia, Canada and the Fed. Rep. of Germany, directed their interventions in the first place, towards a deferment of any conclusive Unesco action. Others, grouping France, Eastern Europe and developing countries, wanted the text adopted forthwith, and won by a majority of 55 in favour, 7 against, with 22 abstentions.

The United States and others opposed the Declaration also on the grounds that any attempt to regulate by international principles the use of outer space for direct broadcasts was a violation of the principle of freedom of information, and thereby also of Unesco's own statutes and goals. Some referred to their national constitutions, which expressly forbade measures restricting freedom of expression.

The fear of the unknown and the uncertainty surrounding a new powerful technology at the service of the few prevailed in the debate. These

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Each country has the right to decide on the content of the educational programmes broadcast by satellite to its people and, in cases where such programmes are produced in co-operation with other countries, to take part in their planning and production, on a free and equal footing.

7 **The objective of satellite broadcasting for the promotion of cultural exchange is to foster greater contact and mutual understanding between peoples by permitting audiences to enjoy, on an unprecedented scale, programmes on each other's social and cultural life including artistic performances and sporting and other events.**
Cultural programmes, while promoting the enrichment of all cultures, should respect the distinctive character, the value and the dignity of each, and the right of all countries and peoples to preserve their cultures as part of the common heritage of mankind.

8 **Broadcasters and their national, regional and international associations should be encouraged to co-operate in the production and exchange of programmes and in all other aspects of satellite broadcasting including the training of technical and programme personnel.**

9 **In order to further the objectives set out in the preceding articles, it is necessary that States, taking into account the principle of freedom of information, reach or promote prior agreements concerning direct satellite broadcasting to the population of countries other than the country of origin of the transmission.**
With respect to commercial advertising, its transmission shall be subject to specific agreement between the originating and receiving countries.

10 **In the preparation of programmes for direct broadcasting to other countries, account shall be taken of differences in the national laws of the countries of reception.**

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There is no doubt that many States could reach mutual agreements on the content of satellite programmes in the fields of education, science, culture and information, dealt with in the Declaration. There would, however, be other cases where such agreement could not be reached and where plans for satellite transmissions would have to be abandoned or revised considerably to avoid breach of the Declaration.

Those who would disregard such considerations would expose themselves to accusations of violating internationally recognized principles, even though the Unesco Declaration is not a binding legal instrument.

Unlike short wave radio broadcasts across frontiers, TV transmissions via broadcast satellite will be extremely difficult to jam. The recognition that this situation is made possible explicitly by the use of outer space which is declared to be governed by international law is seen by some as a justification for the demand for prior consent.

The Declaration, it should be noted, does not attempt to embrace traditional use of radio waves nor does it touch the point-to-point communications that are carried over the INTELSAT systems or similar future satellite systems serviced by large ground stations, over which governments normally will have full control.

Two viewpoints are at loggerheads. One holds that there is an infringement of the right of the individual to have access to information regardless of frontiers, and the other, that there is a violation of the rights of sovereign and independent states to decide for themselves what programmes their people should be exposed to.

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The Unesco Declaration attempted to establish a balance between conflicting views while formulating principles which would be meaningful and internationally accepted. As the General Conference debate showed, however, full consensus was not achieved.

Meanwhile, the technology is moving forward rapidly. The newly launched Canadian satellite ANIK is transmitting colour television signals which may be picked up in the United States, without hindrance, as well as in Canada, by means of specially constructed antannae much less expensive than the large ground stations previously used. Direct broadcast satellites are already being manufactured.

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AFRICA IN THE STRESS OF TECHNOLOGY

by Ali Lankoandé

Photo Georg Gerster © Rapho, Paris

24 **MODERN LINES. The University of Dar-es-Salaam, "the dwelling-place of peace", capital of the United Republic of Tanzania. With campus buildings of strikingly modern design, the university numbers over 1,500 students in its faculties of literature, law, science, the social sciences and medicine.**

IN the countries of the Third World there is, strictly speaking, no tension between traditional culture and technology. In Africa, for instance, technology is integrated with culture.

In "La Civilisation Africaine d'Hier et de Demain" (African Civilization Yesterday and Tomorrow) the historian and sociologist, Joseph Ki-Zerbo, of the Upper Volta, describes traditional black African society as follows:

"It was a perpetually inventive society. Technically and economically, each family, each village, each tribal group discovered how to live in a positive equilibrium with nature. No further proof is needed than the varieties of seeds chosen, the methods of cultivation, the extremely varied range of tools and methods of co-operative work, and the host of cures

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ALI LANKOANDE *is a member of the National Assembly of Upper Volta and a former member of the Upper Volta National Commission for Unesco. He is vice-president of the Scientific Council for Africa and professor of physics at the Ecole Normale, Ouagadougou. The article presented here is adapted from a text prepared for a Unesco Symposium on "Culture and Science" which is shortly to be published in a Unesco-Presses Universitaires de France book entitled "La Science et la Diversité des Cultures".*

The tensions created by the introduction of modern science and techniques into Black Africa

devised, even if they were administered with a wealth of magic ritual."

Tension does however exist, and is to be found among an intellectual élite and all those with some education who have acquired a scientific background, whatever the level, while still living in a non-scientific society; for example, one finds not only people with little education, but also the well-educated, consulting the local marabout or wise man.

The origin of this tension seems to lie in the juxtaposition of cultures, which is apparent at all levels of daily life: ploughing is done to the sound of a transistor, and the use of charcoal as a fuel is contemporary with the use of the motorcar.

This produces a disequilibrium which appears from school onwards. The African child studying scales in his physics class has never seen scales, unlike the European child who sees them every day.

The upshot of this disequilibrium is that in the countries of the Third World science has a twofold nature.

On the one hand, in everyday practice, science is not backed up by theory, with the result that real use

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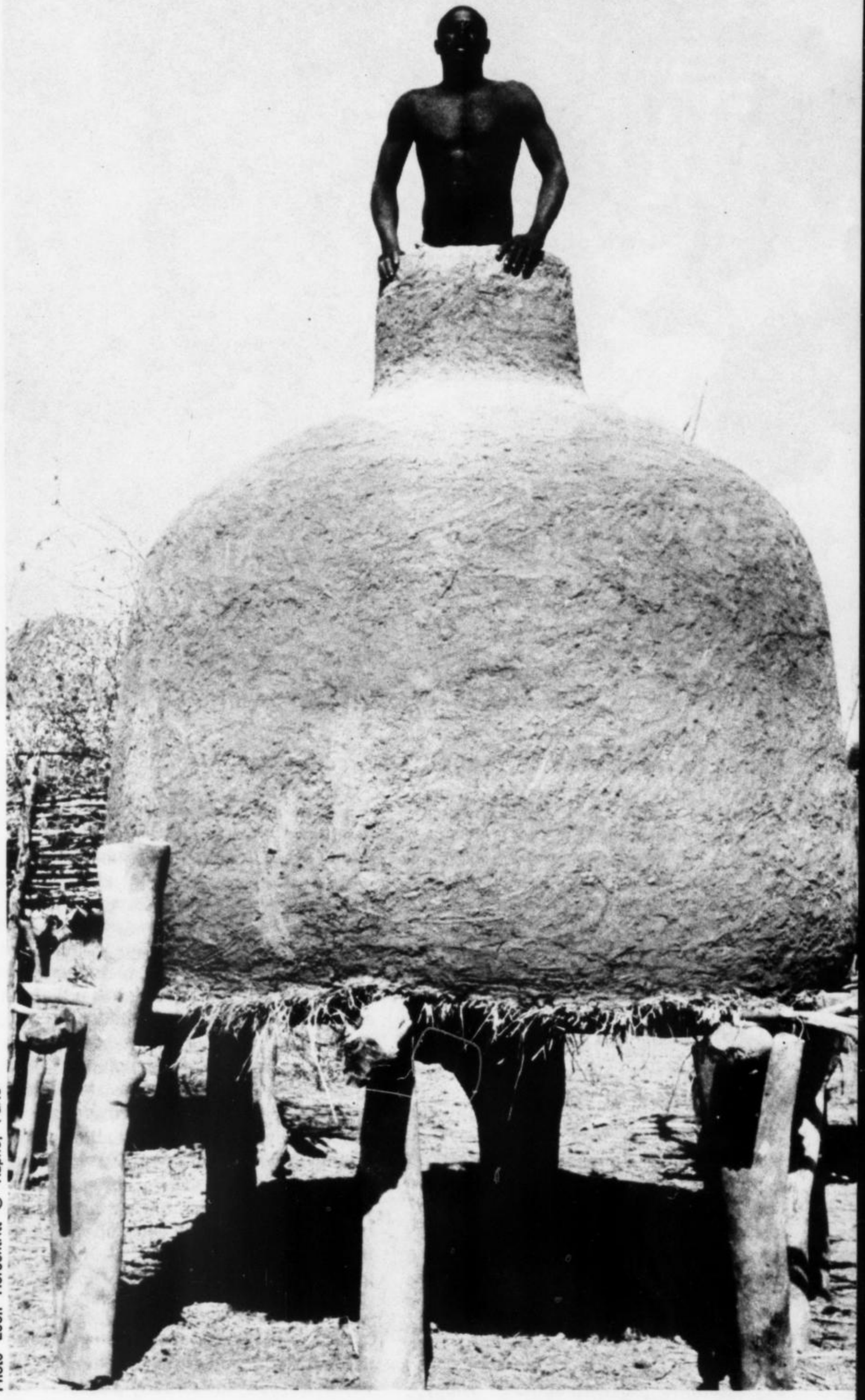

Photo Léon Herschtritt © Rapho, Paris

TRADITIONAL WAYS. This millet store on the outskirts of Fort Lamy (Chad) is set on stilts to protect it from animals and damp. Built of mud and fashioned in a traditional shape, it has an opening at the top in which a man stands to tread the grain down. When the store is full the "manhole" is tightly sealed.

cannot be made of it. In his book "L'Afrique Noire est Mal Partie" (Black Africa is Off to a Bad Start) the French agronomist René Dumont provides an excellent example of this when criticizing the premature use of tractors in cases where farming has no need of modern techniques. The employment of tractors would not only be inefficient but would exhaust soils to which they are not adapted. Technical means are only efficient when they form an integral part of a fully worked out technology.

On the other hand, theories are not sufficiently tested in practice; where such practice exists, it is only in laboratories or in a vacuum, cut off from everyday life. Inevitably, science seems incomprehensible.

To the extent that it is on the fringe of the development of productivity the Third World appears to be bypassed by scientific developments. Today, science and technology are as it were "parachuted" into these countries; and this being so, it is very unlikely that they can help to develop a productive system of which they are not themselves the product.

In that case, if science is to put itself genuinely—above all, effectively—in the service of the human community, and if it is to promote a dialogue between cultures, how can it be integrated with them, or how can culture be adapted to science?

The most urgent problem is that of assistance, primarily technical, to the Third World countries. It seems that there are two possible solutions, the first of which would be to adapt technology to the development of productivity. Emphasis should be laid on the development of rural production, which should of course become increasingly industrial, but a start should be made on the workshop level in order to ensure a type of industrial development appropriate to the country.

Africa, therefore, must in large measure go through the stages through which Europe has already passed. Yet a "rapid" solution could also be visualized which would consist of introducing the most modern machinery together with foreign technicians who would train national technicians to take over as soon as possible.

Each of these solutions has its advantages and disadvantages. In the first case it could be maintained that the more gradual the initiation the more effective it is likely to be. But has Africa the time to spare for this kind of initiation if she is to progress? Is the centuries-long development of techniques that Europe experienced really indispensable?

The second solution, that of rapid modernization, would place Africa four-square in the twentieth century. Here one might quote the recent examples of Japan and China. Yet the history of technology in Africa should not be underrated: we need only think of the technical mastery required to work brass by the lost wax process.

The disadvantage of pressing on rapidly is perhaps the very real danger of not being able to keep up with technology, since techniques and their tools must correspond with needs.

As far as the training of the individual technician "at the machine" is concerned, does this really provide the necessary instruction to enable him to transfer later to other, more sophisticated types of machine?

Photos © Paul Almasy, Paris

LIFE CYCLE OF A VILLAGE

In the heart of rural Niger, an instructor at a special course on agricultural economy explains to villagers the economic cycle on which their daily work is based. The village is represented at the centre of the drawing on the blackboard (see detail left); to the left of the blackboard are shown the fruits of the earth—grain and vegetables; flocks of sheep and goats; skins and tanned leather; food and millet stocks. Surplus production is converted into money with which to acquire (right) foodstuffs and animal stock that cannot be produced locally.

Everything hinges on the way such instruction is given.

If it is only a matter of learning a number of specific movements necessary to work the machine or to repair it if need be, the most that is being achieved is the production of good operatives for particular machines. But one does not have to go to university to have a well thought out training. On the spot training can include teaching in the wider understanding of mechanical processes.

At a broader level the problem is perhaps more difficult to resolve. To what extent does the latest equipment effectively meet a country's needs? What use, for example, is a computer in an African bank? There is the double risk of costly under-utilization of the computer and of causing unemployment. As far as possible the unemployment which, in Europe, followed each step forward in mechanization should be avoided. This is a problem of both policy and planning.

Immediate effective modernization is never modernization at all costs, but the result of prospecting both the market and the needs of the individual country.

It is a mistake to imagine that there is a simple solution. To take the example of rural schools: the education they provide, which aims at keeping the child in contact with his farming environment and at turning him into a farm worker who knows his job, is in itself excellent. Yet only too often rural schools are a failure because those who have been trained in them—by instructors who have not themselves assimilated the cultivation techniques taught—go back to their traditional village cycle of cultivation, where they find themselves completely isolated.

Not only are they unable to make others benefit from the skills they have acquired, but they forget these skills themselves. The general education they have received makes them drift to the towns, since their schooling has not changed their situation in the village.

It is not possible to produce effective results operating on too small a scale or with makeshift resources. Similarly, the introduction of the most modern methods is not in itself enough.

For example, in Upper Volta, in the Sahelian region, near Markoye, a very modern cattle farm was established as an experiment, with carefully selected and supervised stock and suitably prepared fenced-in pasture land. Yet this experiment in rational, intensive stock farming seems to have been a complete failure. The reason was that it antagonized the local people. They were deprived of pastureland and wells which were reserved for the experiment, did not benefit from the services of the farm veterinary surgeons, and were unable to understand what the experiment was about.

The first thing to be done, therefore, is to estimate needs on a national level and sometimes for several countries at once. For example, a computer which is uneconomic at national level may be worthwhile at the multi-national level. A highly sophisticated textile production line, a modern distribution network, a fruit marketing or stock-breeding system, the construction of roads, river control—all these major undertakings sometimes break down on a national scale for lack of skilled personnel, while throwing people out

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AMERICANS READ MORE BOOKS THAN EUROPEANS

A German specialist debunks two fallacies:

1) Americans rarely ever read
2) The books they do read are of lower quality

by Heinz Steinberg

SOCIOLOGISTS, psychologists and economists have done a great deal of research into book reading, borrowing and buying habits in European countries and in the United States, but so far no systematic comparison has been made between the pattern in Western Europe and that in America.

Where researchers have ventured to compare the two, they have usually expressed opinions based at the best on largely random observation and more often on preconceived ideas that take root and reappear even in scientific conclusions.

In an otherwise useful analysis of the book market in the Federal Republic of Germany, published in 1968, a German demographic institute reproduced the figures of an American opinion research institute unchecked and concluded that "Americans very seldom pick up a book". This assertion, of course, is completely unfounded. By checking statistics, the German institute could have found out that people in the United States buy twice as many and borrow three times as many books, per inhabitant, as people in the Federal Republic of Germany.

Not only the Germans but Europeans in general, priding themselves on their culture, find it difficult to believe what is nevertheless an indisputable fact—that in the U.S.A. books have a greater distribution in relation to population than in Europe.

Before looking at the evidence for this, let us deal with the objection—another product of the European preoccupation with Culture—that Americans may indeed buy more books, but the books are of lower quality—another unfounded argument.

Obviously a great quantity of light reading matter including detective stories is sold in the U.S.A. as elsewhere, but in practically every case where large numbers of books are on sale or on loan, one also finds "serious" reading matter, works by Shakespeare or Thomas Mann for example, and, above all, non-fiction ranging from gardening primers to dictionaries.

On my last trip to America, in Madison, the capital of Wisconsin, I came across a drugstore at a considerable distance from the University where a copy of Plato's Symposium was displayed alongside a tablet of soap, and in an area of Washington largely occupied by Negroes I found practically the whole production range of a London fine art publisher at much reduced prices, including some excellently illustrated works on the collections of Spanish museums.

In particular the American output of paperbacks is far greater than that of Western Europe. The total membership of book societies must also be considerably higher in the U.S.A., in relation to population, than in most European countries. Moreover, American book societies can provide a much more specialized service. One can join a book club, for instance, in order to buy nothing but sports literature.

Another point to note is that book societies in Europe differ considerably in their function from country to country. French book societies generally attract custom by high-quality binding whereas the large-membership German societies are noted for their low prices which have enabled them to sell to a section of the middle-class public that normally buys few books, and to some extent to a public on the skilled worker level as well.

The reason for the high book output in the U.S.A. is obvious to anyone travelling through North America. In the New York subway a European is struck by the large number of people reading books, although one reason for this may be the difficulty of opening up a newspaper during the business rush hour. A book can be easily held in the hand and slipped back into one's pocket.

In the town centre of Minneapolis, in Minnesota, I spent hours watching customers in a large bookshop and time and time again saw people carrying five or six volumes to the cashier—and these people obviously came from varied classes, including those which are rarely found in a bookshop in Europe.

This, in fact, seems to be the core of the difference between Europe and America. In Europe, at any rate in western and southern Europe, including the Federal Republic of Germany, to some extent, and also in Great Britain and Scandinavia, books are associated in the mind of the public with that section of the population which regards itself as "cultured".

In North America it is difficult to detect any relationship of this kind. For Americans a book is something to be used, valued for its utility, regardless of social standing, until it can be dispensed with. To quote Robert Escarpit's helpful classification, books fall into three categories of descending importance: first, the "functional book", secondly the "literary book" and thirdly the "book as an object"

HEINZ STEINBERG, *of the Federal Republic of Germany, is Director of Further Education of the municipality of West Berlin, and lectures on the sociology of books at the Free University of West Berlin.*

Photo Leonard Freed © Magnum, Paris

Time out for a chat at the famous annual international Book Fair held at Frankfurt (Federal Republic of Germany). In 1972, International Book Year, some 3,500 publishers, including 2,600 from all over the world, displayed books at Frankfurt.

But in Europe books have always been surrounded by an aura that does not seem to have paled, and this aura significantly increases the prestige of persons who read, or who are reputed to read books.

It would be an exaggeration to say that cultured Europeans still carry the book status symbol before them like the fathers of the church pictured in the magnificent mosaics in the Basilica di Sant'Apollinare Nuovo, Ravenna (Italy), but to the extent that books are status symbols for the "cultured", their use by the "uncultured" is impeded.

This psychological barrier has set a limit to the growth of book reading in Europe and people who can read do not necessarily read books. Manual workers in particular are subconsciously "afraid" to venture into a bookshop or a library.

In America, unsaddled by such traditions, the book reading habit has developed more easily with the spread of literacy, beyond the limitations of class and race. People read not so much for the sake of the cultural value of reading to which so much importance is attached elsewhere, but because they have discovered the plain usefulness of reading or wish simply to enjoy the pleasure that it gives.

This is more fertile ground for the growth of book reading than any cultural formulas. Anyone who wants to help countries to develop with the aid of books should reflect on this and refrain from talk of cultural improvement.

Because of the basic situation just described, America is better at advertising books. Admittedly, this has led to the questionable importance of the best-seller system, but its main manifestation is the fact that books are promoted by the public authorities in a way which has no parallel in Western Europe. These activities have been conducted for years with extraordinary success by the National Book Committee in New York.

At Miami Airport in Florida there is a self-service kiosk for newspapers and magazines which also has paperbacks on display on a few stands. In November 1971, I bought a 300-page paperback for 75 cents with the title "The Wonderful World of Books".

No less than 72 authors are represented in the book. Their contributions are taken from papers given at a conference on rural reading held in 1951. The conference was organized by the U.S. Department of Agriculture, in Washington, which had invited experts to come from all over the world in order to promote book reading in the rural areas of the United States.

It would be difficult to find a book like this in Europe. There have, of course, been conferences, and their papers have often appeared in print

CONTINUED NEXT PAGE

but certainly not in the form of a paperback for the customers of an airport kiosk and they have never become long-sellers, still being ordered 20 years after the event.

It is practically inconceivable that a Ministry in the Federal Republic of Germany, and particularly the Ministry for Agriculture, would sponsor a conference on reading. Why should this be so? The answer is that although discussion of books is traditional in Europe, it never escapes from the cultural area and too little thought is given to the interaction between book and reader.

But it must also be acknowledged in making a comparison, that the book-buyer in America faces disadvantages other than those experienced in Europe. Large and obviously well-run bookshops exist in American cities, often with considerably bigger stocks than, for example, French booksellers in similar sized towns. But they—and often the chain stores too—are not generally prepared to put books on order. The usual reply to an enquiry for a book that is out of stock is a sympathetic shrug of the shoulders.

There are a few firms which specialize in ordering books and they generally supply through the post against telephoned orders, which is practically equivalent to buying blindfold, whereas traditionally a European bookseller is quite prepared to order books without obligation.

Another unfavourable aspect of the American book market surfaces when a book has been struck off the publisher's list. The only answer is a good secondhand bookseller, of which there are very few. In any case the price rockets and if no new edition is in sight and a reprint is regarded as unprofitable, the price of a book in considerable demand may reach astronomic heights. Often the only solution is to make a photocopy of the whole book in one of the libraries, an expensive process apart from the problem of copyright.

Although in per capita terms considerably more copies of books are printed and sold in the United States than in Europe (leaving aside the number of titles for which the comparison is different), anyone looking for a specific book may often feel let down by the American book trade.

The libraries however are prepared to obtain any book, and a European finds himself singing, with few reserves, the praises of American libraries, except, perhaps, in some respects, for the largest of them all, the Library of Congress.

This world-famous library has individual works of unique rarity and collections which are astonishingly comprehensive. In its bibliographic work alone its services are irreplaceable. But its great size is obviously a handicap. The operation of a library running to tens of millions of volumes in overcrowded old-style buildings is difficult to organize satisfactorily and the time taken to obtain a single book recalls the operations of the big old European libraries rather than modern American methods.

More modern libraries, however, offer more than just the benefits of technological innovation; their operating systems have generally been so well thought-out that a user accustomed to libraries in Europe has the feeling of being transported into a book paradise.

The Joseph Regenstein Library, for example, on the campus of the University of Chicago, has been built to house 3½ million volumes although it serves only the humanities and the social sciences, and within a year of its opening, already had 2 million volumes each directly available and easy to find from early morning until late at night.

Even the stock of foreign-language reference books is larger than that in many university libraries in the countries where these languages are spoken. There is no congestion since space is provided for 2,900 readers, half in comfortable cubicles and the rest in partitioned conference rooms.

Europe's culture pessimists tend to complain that books are threatened by electronics and yet American experience in no way justifies such fears. On the contrary, data processing with high-speed printout is often used in the service of books and seems to have the effect of reinforcing the demand for them.

In scientific information an increasingly important part is being played by literature which is not sold through the book trade, such as duplicated conference papers, lectures, typewritten reports on the results of industrial research and individual articles in journals. America has already managed to bring this great flow of paper under control by a combination of computer and microfilm.

All the user has to do is to thumb through the catalogues, but once he has found the reference he "types" this in himself on a keyboard and above it, on a television screen, appears an abstract of about eight lines. It is then easy to decide whether to borrow or buy the publication.

This can be in the form of microfilm costing a few cents and whose use

Latest profile of world translations

World figures for translations are still rising—41,322 works appeared in translation in 73 countries during 1970 compared with 38,172 in 65 countries in 1969—according to the most recent issue of "Index Translationum", Unesco's annual bibliography of translations (1).

For the first time in many years the U.S.S.R. does not lead the field for the number of works translated. The Federal Republic of Germany and the German Democratic Republic, are now in first place with a combined total of 5,932 translations, followed by the U.S.S.R. with 3,580. Spain, whose translations rose from 2,737 to 2,944 remains in third place.

Up to fourth place (from sixth in 1969) goes the United States with 2,569 compared with 2,059, overtaking Japan, still lying fifth with 2,069 (a drop of 98). France comes sixth with 1,918, then come the Netherlands with 1,651, Italy with 1,587 (compared with 2,483 in 1969 when the country was fourth), Sweden with 1,539 and Czechoslovakia with 1,440.

Translations of the Bible continue to rise: 223 in 1970 compared with 202 in 1969 and 187 in 1968.

Lenin is still the most translated author and the celebration of his centenary in 1970 more than doubled the number of his works translated (448 against 202). After Lenin comes Shakespeare (141), Jules Verne (128), Georges Simenon (119), and Enid Blyton (108).

Among the leaders figure both classical authors and thriller-writers. Agatha Christie with 95 is followed by Dostoievsky (78), Dickens (77), Balzac (75), Mark Twain (71), Hemingway (68), Pearl Buck (65) and Steinbeck (61). Behind Hans Christian Andersen and R.L. Stevenson with 56 and 55 comes a mixed field of James Hadley Chase (53), Dumas père (51), Hugo (47), de Maupassant and Somerset Maugham (46), the Grimm Brothers (43), Goethe (37), Stendhal (33), the Brontes (31), André Maurois (30), Faulkner (29), Daniel Defoe (25) Desmond Morris and Ian Fleming (24), Thomas Mann (20), François Mauriac (18), Kafka (17), Simone de Beauvoir (12) and Miguel Asturias (12).

Among the Ancients, Plato and Homer tie with 48 each, ahead of Cicero (34), Aristotle (30) and Sophocles (30).

Writers who have won the Nobel Prize for Literature stand high: Beckett has been translated 53 times, Alberto Moravia 50, Sartre 42, Camus 40 and Solzhenitsyn 35 times.

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(1) "Index Translationum" Vol. 23, Unesco, Paris, 1972. Price $42, £14, 168 F.

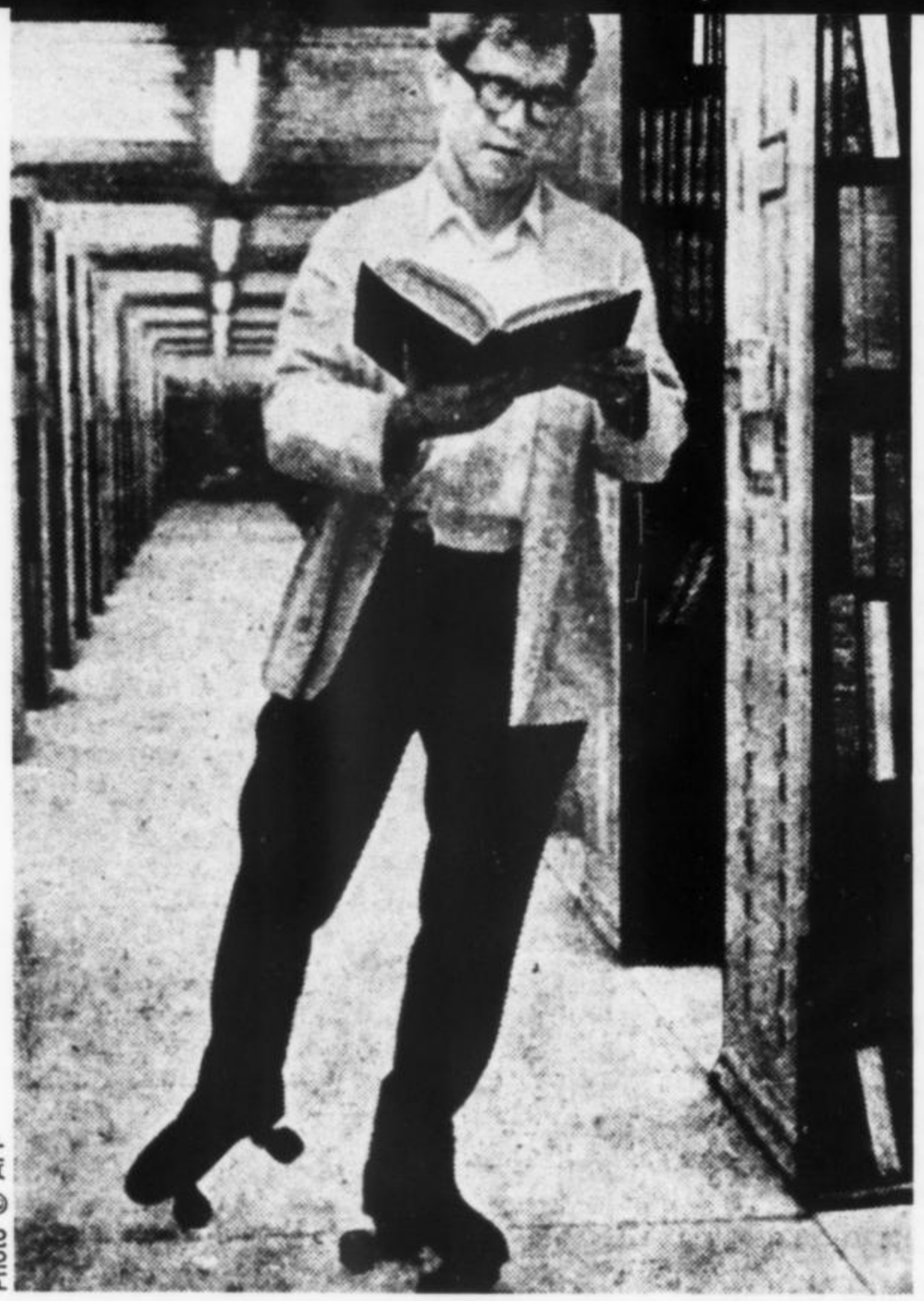

Photo © AFP

QUICK SERVICE SKATER

To speed up its operation, the New York City Public Library has equipped employees with noiseless roller skates. Here a librarian skates down one of the interminable corridors of the reserve stock rooms—dipping into a book as he skims along. The library has more than 7 million volumes and over 80 branch libraries.

is explained on a film reader, or in the form of photocopies, considerably more expensive, which one can read, of course, in the same way as a book. But the requirement, at least initially, is often met by the abstract, a reproduction of which is produced on operation of another knob above the screen. This can then be inserted into one's own card index and used again when reading other books.

It is possible to imagine that books might become superfluous in the future to the extent that scientific information could be directly stored in and retrieved from the data-processing equipment. But the very large numbers of people needing to refer to literature that is not so highly specialized will continue to read books in their conventional form, and American experience goes to suggest that this need will continue to grow because the apparently competing media of television, film cassettes and video recordings tend to stimulate book-reading rather than the reverse.

For America the growth in the public libraries is of greater quantitative significance and more important in cultural policy terms than the very impressive development of the scientific libraries. These public libraries, more numerous every year, offer services beyond comparison with those of public libraries in Western Europe where imperfect user guidance is generally typified by the limited time for which they are open.

Countless new buildings, even in small townships, and whole fleets of mobile libraries for people living in the country, drive the statistics of American book stocks and borrowings higher and higher. The example of a small and externally unattractive branch (though the aesthetic charm of American public library architecture cannot be denied) in a nevertheless well-to-do Washington suburb made the most lasting impression on me.

Seeing a brand new set of the Encyclopaedia Britannica I told the librarian how pleasant it was to find such an expensive reference work in so small a library. But in the library store there was a second copy. Readers had occasionally asked to be allowed to borrow one of the volumes in order to study a major article quietly at home, but the complete Encyclopaedia always had to be available for reference, explained the librarian.

She then drew my attention to another recent acquisition, an Italian dictionary. "There are many Italian families living here", she said. "The children, particularly, are always borrowing books but their parents, whose English is not so good, also want to know many things which are not in our dictionaries, and they are naturally happy to have memories revived in their mother tongue."

When she was talking I was reminded of the Italian immigrants back in my country. Would they receive this sort of attention in a public library? Hardly, since German libraries, in spite of many extensions, are unable by and large to meet the needs of the people as a whole to anything like the same extent as American public libraries.

Even if the librarian in Europe were to acknowledge a democratic duty to serve minorities as well, he would find it difficult to obtain enough funds from the authorities responsible for his library when resources are not even sufficient for the needs of the majority.

America, then, may well serve as a model to Europeans in the field of public libraries. English and Scandinavian libraries have for a long time successfully followed the American example. Other countries should do the same.

This is the only effective way to repair the harmful effects of a tradition which, by placing books on a pedestal, has in fact withheld them from those who need them most. ■

THE FRAGRANCE OF BOOKS

A new development in publishing: books which give off a lovely scent when the pictures and other illustrations are lightly scratched with the fingernail. At present available in children's books produced by the English publisher Paul Hamlyn, the scents offered include cherry, orange and pine. No wonder the four children, right, now always have their noses in books!

Photo © "The Times", London

AFRICA IN THE STRESS OF TECHNOLOGY *(Continued from page 27)*

of work. But they are possible on an international scale.

But the problem then arises in another connexion at the political level. No African country singly is in a position to master and make effective use of modern technology and technological achievements. It is thus necessary to reach multinational agreements and to synchronize planning estimates, at least by economic groupings.

Unity is essential, if compensatory arrangements are to be possible between different African countries: surely Africa cannot reject an enlarged market, of the kind that developed countries such as those of Europe are obliged to form?

STILL at the political level, and related to this problem, is the choice of methods for industrialization. Industrialization may start with foreign and private resources, or alternatively be national, either private or state-financed. It is for Africa to choose, but with the proviso that different economic and political choices should not prevent the unity required for planning on an international scale.

Problems of planning and policy involve obtaining the maximum return from technical assistance. While technical assistance is seen as the first method of enlisting science in the service of the human community, the second method, every bit as vital, is education.

Even more than in Europe, it is necessary in Africa for science and culture to go hand in hand. European thought is in essence technical, even where it has forgotten its origins. Bergson said that intelligence fabricates concepts as it fabricates tools: and surely concepts are nothing else than intellectual tools.

The European child is born and brought up in technological surroundings, with increasingly technical toys, such as the transistor radio set he can assemble himself, walkie-talkies, and sophisticated moon rocket models.

Such an ambiance does not exist in Black Africa; yet the African way of thought is of a basically practical nature, whether in religion, dancing or morals. African culture is something which is experienced and practised in depth.

Science, which is well thought out methods put into practice, can make use of this practical culture to banish both misery and ignorance, and to open up new creative possibilities to culture. This calls for action on two fronts, both in and out of school. In school, the introduction to technology should be fairly extensive, and here particularly, manual and intellectual work should go hand in hand.

A type of education must be devised which is based on current practice, and theory must be taught on the basis of such practice. This, of course, calls for a complete revolution in education; but such a revolution is possible.

The revolution in education also means that wherever possible, the most modern methods and techniques should be used. In certain African countries educational television makes up for the shortage of teachers and provides schooling for children who would otherwise never go to school.

But an effort should also be made outside schools, and here experiments, such as literacy campaigns, have already been attempted. But too often such attempts have been "sketchy". Literacy teaching should not consist merely of teaching people to read and write and of giving a few words of advice to mothers. Shock tactics should be adopted and real people's universities should be created alongside the traditional universities which all too often are cut off from the life of the country.

TODAY reading and writing are of secondary importance and brief instruction in these techniques is ineffective and soon forgotten. It is much more important to listen. More and more news is transmitted by radio which is now universally available. Why not make full use of the radio? Our epoch seems everywhere to be one of word and image and in this it resembles traditional African civilization. This is a line of approach that should be exploited to the full.

Radio will provide the spoken word. Existing practical information programmes should be developed into a real "flood" of technological broadcasting. This means that at the same time, there should be adult education evening classes in the countryside and the towns, in order to apply the spoken word in practice. A start should always be made on what is useful in everyday life: there should be broadcast courses on child care, how to mend a plough, how to look after a bicycle or a motor-cycle.

Whenever possible the spoken word should be backed up by the image, but, quite apart from considerations of the technical difficulties of television and its cost, it must be handled with care. It must not be forgotten that few African peasants know how to "interpret" a photograph and a great deal of training in the comprehension of the image will be required. Television is so costly that it must not fail to achieve its objective.

IN the final analysis, the tension between science and culture seems not so much an irreducible antagonism as a stage in the development of all societies. The integration of science with culture leads inevitably to a cultural upheaval, affecting all cultures. It is in this way that culture can lead up to a dialogue, and act as a binding force: science, even when "exported", is never exported culture; science and technology can be made universal, and put into effect by all men.

But there is still tension in this act of communication, arising from the fact that the vehicle of science is culture, which is never universal. There is no such thing as "imperialist", or "communist" or ideological science; but ideologies for scientific development do exist, and are inevitable.

When assimilating science, culture confers on it a particular significance. That is why we prefer the expression "adjusting culture to science", i.e. developing society in one and the same technological and cultural movement, and giving that movement its ultimate direction.

Faith in science is the same as faith in man. If scientific development is truly bound up with the development of productive forces, both accompanying such development and acting as a stimulus, the inevitable result will be a major change in traditional cultures, in the same way as cultural change takes place at present in all societies.

We are no more able to interpret the significance of this change than we are able to interpret the significance of history. But like history, it will be the work of men, and it is to be hoped that men will realize what kind of science they are producing, that is to say the kind of society they are thereby constructing. ■

Ali Lankoandé

UNESCO NEWSROOM

BOOKSHELF

RECENT UNESCO BOOKS

■ **Index Translationum**

International Bibliography of Translations, vol. 23. Gives data on over 41,000 titles published in 1970 in 73 countries, 1972, 950 pp. (£14, $42; clothbound, £15.35, $46). *See also page 30.*

■ **Scientific Thought**

Some underlying concepts, methods and procedures

Contributions by 12 eminent scientist. Co-edition Mouton-Unesco, Paris, 1972, 252 pp. (£5, $15, 60 F). *See item this page*

■ **It is Time to Begin**

The human role in development: some further reflections for the seventies, by Malcolm S. Adiseshiah, former Deputy Director-General of Unesco, 1972, 182 pp. (£1.05, $3.50)

■ **Underwater Archaeology: A nascent discipline**

Contributions by 24 leading specialists, 1972, 306 pp. (£3.30, $11; clothbound, £4.50, $15)

■ **Cultural Development: Experience and policies,** by Augustin Girard, 1972, 145 pp. (£1.20, $4)

■ **The Practice of Mass Communication. Some lessons from research,** by Y.V. Lakshmana Rao (Reports and Papers on Mass Communication), 1972, 52 pp. (45p, $1.50)

■ **Cultural Policy in Finland,** prepared under the auspices of the Finnish National Commission for Unesco, 1972, 73 pp. (60p, $2)

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OTHER BOOKS

■ **The World of M.C. Escher,** edited by J.L. Locher. Harry N. Abrams Inc., New York, 1972 ($15). *See caption page 13.*

■ **Guide to Korean Culture,** by Tae-Hung Ha, Yonsei University Press, 1968, 440 pp. ($7)

■ **The Story of Man from Stone Age to Space Age,** by Norman Butterworth, Lutterworth Press, Guildford, U.K., 1972, 190 pp. (£2.50)

■ **Youth Draws Us On Toward the Peaceful World of Tomorrow,** by Frank M. Dunbaugh, Ambassadors of Friendship Inc., Miami, U.S.A., 1972 ($4.75)

■ **Persia: An Archaeological Guide,** by Sylvia A. Matheson, Faber and Faber, London, 1972, 330 pp. (£2.50)

What the world sees on T.V.

A quarter of the world's television audience spends half its viewing time watching programmes imported from other countries, reports the latest edition of the Unesco Statistical Yearbook (*). An analysis of T.V. programme hours in 80 countries reveals that 20 of them transmit nationally produced material for only half or less than half of the time. This indispensable reference book also presents vital statistics on world film production and cinema-going, radio, the press, book production, education and research and development expenditure.

(*) *1971 edition; Unesco, 7, place de Fontenoy, 75700 Paris; $35, £11.65, 140 F.*

Smallpox—target zero

World cases of smallpox have dropped from 2.5 million in 42 countries to 200,000 in 16 countries since the World Health Organization launched its global eradication campaign five years ago. Improved vaccination devices—the jet injector and the forked needle, with which a single health worker can vaccinate from 1,000 to 1,500 persons a day—have helped to achieve this result.

Erasmus prize for Jean Piaget

The "Erasmus Prize" for 1972, awarded by the Netherlands "Praemium Erasmianum" Foundation, goes to the world-famous Swiss psychologist, Jean Piaget. The citation accompanying the award pays tribute to Jean Piaget's work in the discovery and analysis of the structures of the child's thought and his influence on the development of child psychology and education.

Woman of Changsa

The perfectly-preserved, 2,100-year-old body of a middle-aged woman has just been discovered in a Western Han Dynasty tomb unearthed by Chinese archaeologists near Changsa, the capital of Hunan Province, central China. The body was lying in a silk-decorated wooden inner coffin housed inside two other wooden coffins. The tomb itself was surrounded by a 40 cm. thick layer of charcoal which in turn was sealed by a layer of sticky white clay which kept out moisture and prevented decay. More than 1,000 objects were placed between the outermost and the inner coffins, including silk fabrics, lacquerware, bamboo and wooden utensils, pottery, grain and specially made funerary objects. The find is of the greatest value to the study of Chinese history, culture, handicraft, agriculture and medicine of the Han period.

Scientific thought in the 20th century

The ideas, methods and procedures underlying many of the extraordinary scientific discoveries and developments of the 20th century are explained by 12 eminent scientists in a book just published by Unesco. Contributors to this collection of authoritative studies include such famous names as Jean Piaget, Abdus Salam, Satosi Watanabe, Nicolai Vorobyev and Stafford Beer. Entitled "Scientific Thought: some underlying concepts, methods and procedures", the book is published by Unesco's Division of Philosophy in co-edition with Mouton (Paris, The Hague). See "Bookshelf".

Unesco clubs in Mexico

Mexico now has some 40 Friends of Unesco Clubs, most of them in secondary schools, and three out-of-school clubs, one for deaf and dumb children, another at a night school for young workers and a third for students preparing for university. Club activities are co-ordinated by the Mexican National Commission for Unesco which has just published the first issue of a liaison bulletin for Clubs containing a brief history of Unesco and a description of its aims.

Science and Africa — an 'Impact' inquiry

What does the impact of modern technology mean to Black Africa? This important question will be examined in the April-June 1973 issue of Unesco's lively quarterly "Impact of Science on Society" (Vol. 23, No. 2). Thomas Odhiambo (Kenya) discusses "Science and African Needs", Jimoh Omo-Fadaka (Nigeria) describes "The Tanzanian Way", D.P.S. Wasawo (United Republic of Tanzania) surveys "African Science Policies", Aklilu Lemma (Ethiopia) proposes "A Practical Solution to Bilharzia", Landing Savane (Senegal) comments on "The Scientific Lag in Africa" and James Sholto Douglas (United Kingdom) reviews "Forest-Farming". Subscriptions from Unesco National Distributors (see inside back cover) or from Unesco (DPV), Place de Fontenoy, 75700 Paris, France. Annual subscription $4, £1.20, 16 F; each number: $1.25, 40p, 5 F.

Flashes

■ *The average life span of Japanese men has risen to just over 70 years and of Japanese women to just over 75 years, reports the Japanese Ministry of Health and Welfare, due to a big drop in deaths from influenza, pneumonia, asthma and bronchitis.*

■ *Household refuse is reduced by 90 per cent in volume and transformed into an odourless, soil-improving material by a new type of pulverization plant developed by Swedish engineers.*

■ *The International Maize and Wheat Improvement Centre, near Mexico City, reports a major breakthrough in the development of a new high yield strain of maize resistant to many maize diseases.*

■ *A 3,000 kilometre, irrigation and transport canal planned by the Indian Government will cross the sub-continent from north to south and link all the country's major rivers.*

■ *The Government of Togo, with aid from Unesco, has just launched a monthly newspaper specially designed for newly literate persons.*

Letters to the Editor

WORLD'S BEST 100 BOOKS

Sir,

I read with great pleasure your January 1972 issue on International Book Year. I believe that Unesco is going to compile a symbolic set of the world's best 100 books. I strongly suggest that this set should include a work by Dostoyevsky whose literary heroes and images, whatever their psychological complexity, serve as universal vehicles of humanism and man's hopes. I am sure my suggestion will find support among many of your readers.

Y. Nesterenko
Voroshilovgrad, Ukraine, U.S.S.R.

TOO GREAT A LIBERTY

Sir,

I would like to assure your Hungarian artist who looked at International Book Year in your October 1972 issue that a Canadian artist would not have drawn a picture of the Kremlin with books stuck on the roof and labelled it "Eastern Europe"!

Perhaps, however, it was just an IBM executive typewriter at Unesco which automatically substituted the word "North" for "United States of" in the caption under the rather lifeless Statue of Liberty as the "Unesco Courier" was going to press. U.S. of A. typewriters are quite extraordinary machines these days.

Timothy E. Reid
Ontario, Canada

No—it was no "executive typewriter" at Unesco that substituted "North America" for "U.S.A." The captions came with the original Hungarian drawings. — Editor.

CHEMICO-GASTRONOMY

Sir,

We all know that we have reached the point in this fairly advanced technological society of ours where everything we consume—food, air, water—is polluted with one or other chemical additive. It is only natural that the layman should begin to wonder what effect this accumulation of unnatural materials in the human body will have upon the future of mankind. I am very glad to see that the "Unesco Courier" has made itself a forum for discussion of these important questions.

In the debate on the harmlessness or danger of pesticides or chemical fertilizers it is, however, surprising to see the problems stated in such a restricted and one-sided manner by Dr. Norman Borlaug in his article "In Defence of DDT and other Pesticides" ("Unesco Courier", February 1972).

Your readers might be interested to reflect on this "Danish Menu", published in the magazine "Noah" under the heading "Some information about the earth on which we live":

Breakfast: white bread *(with benzoylperoxide and bromate);* butter *(residue of pesticides and antibiotics);* egg *(mercury and lindane);* jam *(colorants, benzoacid, flavouring matters—min. 50 % sugar);* soft cheese *(emulsifying agents and perborate).*

Lunch: rye bread *(propione acid);* margarine *(colorants, antioxidants and preservatives);* marinated herring *(hexamethylene tetramine).* Danish salami *(nitrite);* carrots *(taste of kerosine, endrin and aldrin);* salt *(anticaking agents);* fizzy lemonade *(beets, colorants and flavouring matters);* salad of mayonnaise *(colorants, bacteria, emulsifying agents, antioxidants, flavouring matters and remnants of wrapping).*

Dinner: cured saddle of pork *(polyphosphate, nitrite, residue of antibiotics and pesticides);* tinned potatoes *(sulphite);* wine *(sulphur dioxide);* oranges *(diphenyl or orthophenylphenol).*

TV-tea: biscuits *(bleaching agents, colorants and flavouring matters);* tea *(colorants).*

Inger Hansen
Copenhagen, Denmark

TEACHING : NOT JUST ANOTHER JOB

Many thanks to Unesco for the remarkable inquiry into the educational "handicap race" to which the "Unesco Courier" devoted its June 1972 issue.

As you pointed out, family background is of vital importance—according to the values and ideals of the family, so the child will be more or less receptive to culture.

But the teacher also has a great influence on the child's success or failure in school. Not only must the teacher believe in culture, he must proclaim his faith and fire his pupils with his own fervour. A teacher without faith in his vocation may stifle many young minds for ever. Teaching is much more than just another job.

E. Sandemont
Ham-en-Artois, France

ON WINGS OF SONG

Sir,

I have been a "Unesco Courier" reader for over 15 years, but have never come across articles on singing or great world singers. I hope that you will publish an issue devoted to the role of singing in cultural development.

Your April 1972 issue published a letter from a reader in the Federal Republic of Germany, on a pressing question—the uncritical acceptance by modern culture of the mediocracy. I fully agree with him that nowadays "singers with no voice, mouthing meaningless lyrics, receive the adulation due to the trained singer of real talent".

An economist by profession, I am very grateful to one of Moscow's evening musical schools for adults for opening to me a boundless world of beauty.

A.I. Popov
Moscow, U.S.S.R.

AT GRASS ROOTS LEVEL

Sir,

Last July I attended a conference at Unesco's Paris Headquarters as a member of a British youth organization called "Community Service for the Young European". We heard speakers talking on Unesco's main concerns and aims. I was so impressed and stimulated by what I heard and saw, and by the discussions I had with some of these speakers, that I want to try and stimulate interest and concern for the United Nations and the activities of its various branches, particularly Unesco, in the University here at Bangor where I am studying.

If the U.N. aims at an ideal of uniting *all* people of *all* nations, then the basis of interest and activity should be stimulated at grass roots level. It is because ordinary people think of the U.N. and its branches as an intergovernmental *talk*-shop instead of an international *work*-shop, that it does not achieve more and have greater influence. And I firmly believe that the mightiest of organizations *must* have direct communication with the humblest, least immediately significant strata of mankind, to be successful.

I am an insignificant, uninfluential, penniless and naively idealistic student, but I want to make a positive, practical contribution.

Martin Fairbairn
Bangor, North Wales

END OF AN ECLIPSE ?

Sir,

The "Unesco Courier" report on new concepts of education in the November 1972 issue is, to me, like the sun appearing after the long eclipse over the darkened world of education.

I began attending school at the age of five, and because it was natural for me to write with my left hand I was punished and forced to use my right. I was ridiculed and looked upon as some kind of freak and the psychological effects were severe.

It is only natural then that I should be especially aware of the magnificent advances being made in the education of humanity, mainly as a result of the co-ordinating efforts of Unesco. The tragedy is that so few people in North America are aware of the tremendous work being done by Unesco.

The effort to eradicate illiteracy surpasses William Wilberforce's lifelong effort to abolish slavery. Think of it: a civilization ruled by intellect and not by armaments. May I wish you success in your important task.

Robert Donaldson
Montreal Canada

IN DEFENCE OF PARIS

Sir,

Like all Parisians, and indeed most French people and visitors to France, I am profoundly disturbed at the sight of the modern tower blocks at La Défense which have destroyed one of the finest views in the world, along the broad avenue leading westwards from the Arc de Triomphe. As they stand, these towers will cause great harm to French prestige and to the tourist industry.

M. Commelin
Paris, France

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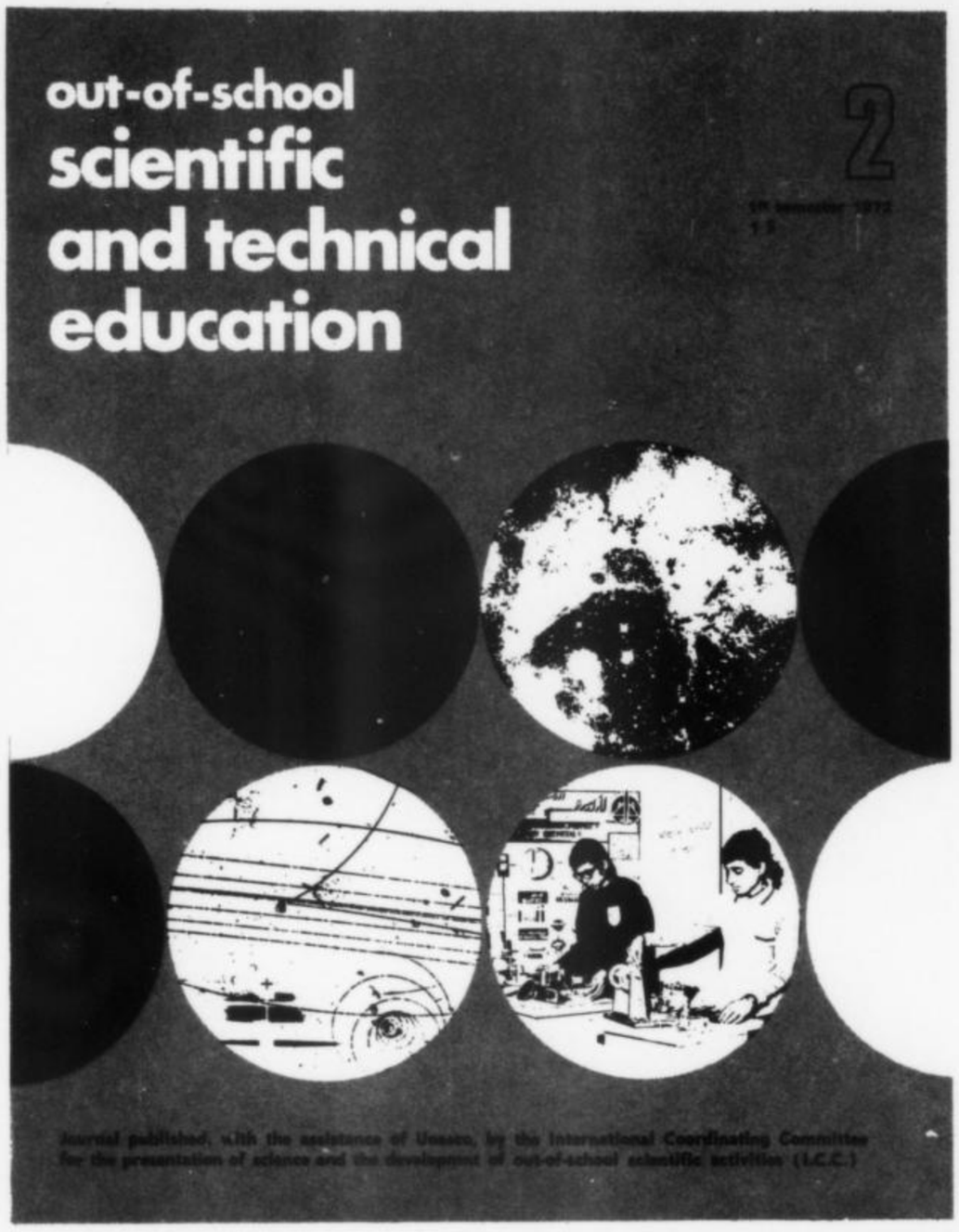

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'MAIDEN' Vs. 'ELEPHANT'

This mask from Nigeria is a striking example of traditional art of Black Africa. It represents the "Maiden Spirit", symbolizing good, gentleness and beauty and is used in a ritual dance-drama in opposition to the "Elephant Spirit", representing force and violence. The mask is now in the Nigerian Museum, in Lagos, Nigeria. The problems of traditional Black African culture today in the face of science and modern technology are discussed in an article on page 24 by Dr. Ali Lankoandé, Professor of Physics at Ouagadougou, capital of Upper Volta.

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